

REPORT ON SURVEY OF
NORTH CAROLINA
INLAND PORTS AND WATERWAYS



PREPARED FOR
THE DEPARTMENT OF CONSERVATION AND DEVELOPMENT
PARSONS, BRINCKERHOFF, HALL AND MACDONALD
ENGINEERS
NEW YORK
1954



Survey and Report
on the
INLAND PORTS AND WATERWAYS
of
NORTH CAROLINA

Prepared for the
DEPARTMENT OF CONSERVATION AND DEVELOPMENT



June 1954

Parsons, Brinckerhoff, Hall and Macdonald
Engineers

51 Broadway, New York 6, N. Y.

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June 26, 1954

Mr. Ben E. Douglas, Director,
Department of Conservation and Development,
Raleigh, North Carolina.

Dear Mr. Douglas:

In accordance with our agreement with the Department of Conservation and Development, dated October 26, 1953, we have completed an engineering and economic survey having particular reference to the development and better use of North Carolina's inland ports and waterways. We are pleased to submit herewith the report covering our findings and recommendations resulting from that survey.

The many and varied problems encountered during the course of this study present a challenge of considerable magnitude. Bringing them into proper perspective, so that their interrelationship may be revealed, has necessitated rather extensive analyses of economic patterns in both North Carolina's Coastal Plain and its hinterlands. This report attempts, not only to identify these problems, but to suggest courses of action which may assist in resolving them.

It has been an interesting assignment. The many courtesies you and your associates have extended to our staff have made it indeed a pleasant one. All Division heads of the Department of Conservation and Development, and their people, have given unstintingly of their time in meeting our factual needs. In particular we wish to express our appreciation for the office facilities and other services so generously supplied by the Divisions of Water Resources and Commercial Fisheries at Raleigh and Morehead City. We also take this opportunity to express our sincere thanks to the individual members of the Board for the cooperation and helpful suggestions which they extended during our several meetings. We cannot begin to enumerate the many others who have rendered useful assistance, except to say that our contacts in North Carolina have been most pleasant and gratifying.

We feel that this study has been truly worthwhile and trust that such beneficial results as may accrue therefrom will serve the best interests of North Carolina and reflect credit to the initiative and foresight of those who saw its need.

Very truly yours,

PARSONS, BRINCKERHOFF, HALL & MACDONALD

Alfred Hedefine

Alfred Hedefine

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INTRODUCTION

On October 26, 1953 the Department of Conservation and Development of the State of North Carolina, entered into an agreement with the Consulting Engineering firm of Parsons, Brinckerhoff, Hall and Macdonald whereby the latter would prepare and submit, within a period of eight months, an engineering and economic report, pertaining to the development and better utilization of North Carolina's inland ports and waterways.

The need for a survey of this type had been recognized for some time by both public and private interests. Bringing this interest to focus, the North Carolina Coastal Marine Council, organized in September 1952, successfully sponsored the authorization, by the State Legislature, of the present study. The members of the Council have assisted materially in its conduct.

Although North Carolina is playing a major role in the current economic and industrial resurgence of the South, the eastern portions of the State have not, at least up until the recent past, shared fully in the benefits of these economic realignments. Considering the wealth of human and natural resources in Eastern North Carolina there would appear to be no valid reason why that area should not participate more extensively in these impressive developments. This viewpoint is particularly in order when consideration is given to its vast network of interconnected natural and improved waterways.

For many years one basic assumption, relative to water transportation, has been more or less taken for granted: that this form of transport is invariably cheaper than rail or truck. Neglecting for the moment the possible oversimplification of this assumption, and considering the large part transportation plays in the total cost of the delivered finished product, it would seem to follow that the coastal areas should, by virtue of their inland waterways, enjoy a potential advantage over inland regions. Then, unless there are other factors which impose handicaps, proper exploitation of these waterways should result in the coastal areas acquiring a definitely favorable position over competitive regions.

Although, in general, this reasoning is valid, it does tend to overlook or minimize some equally basic concepts. One of the more obvious facts is that waterways, and all their attendant plant and facilities, do not in themselves create prospective water-borne tonnages. Only the factories, farms, and other raw material producers can accomplish this in their search for markets. The question is, which activity is cause and which is effect. To state categorically that tonnages must be available or actually moved by other means before water-borne carriers will establish competing services is in some instances an equally fallacious generalization.

There are too many complex and interrelated factors to admit of solutions based upon either of these simple hypotheses. However there is a third assumption, the validity of which is more often supported than it is violated by observed conditions in other sections of the country. This is to the effect that water term-

inals - which are the gateways to a water haul - are rarely successful without the support of a healthy economy in their immediate hinterlands.

There is a certain amount of truth in these and other assumptions. In order to evaluate their applicability to the specific problem with which this survey is primarily concerned it has been found necessary and helpful to develop rather detailed analyses of the Coastal Plain's regional economy. In fact, in numerous instances, it has been desirable to trace out possible influences which source from outside the geographical limits of that specific area. In many cases it has been necessary to use State-wide or even National experience as yardsticks by which added significance might be given to Coastal Plain production, trends, and other conditions.

So far as is known, no one has given a completely satisfactory explanation for Eastern North Carolina's retarded growth rate in the past, and certainly no valid reason for its continuation. Nor does this report presume to have found direct and uncomplicated answers to these problems or simple solutions by which they may be quickly resolved. We believe, however, that the more important factors which condition the coastal economy have been inventoried and their interrelationships explored. It soon became apparent that a proper evaluation of these elements must furnish the basis for any realistic plan of action or altered policies with respect to the inland waterways.

During the course of this survey many impressive advances and factors giving promise of future developments were observed. In fact some precaution had to be exercised lest these tend to obscure those less promising features which might have a critical bearing upon the success of suggested programs. It has been necessary to varify many previously accepted facts and figures. Unfortunately some of these have proven inaccurate or have lead to popular misconceptions. On the other hand some very real advantages have been greatly under-evaluated.

The scope of this survey has necessitated extensive references to a very considerable number of sources and authorities. To list and acknowledge only the more important of these would require many pages. In some instances where data or opinion have been presented which may have originated from other than official or quasi-official sources, the authority has been identified. Even among the many official sources consulted, serious inconsistencies in factual data have been numerous. In these cases attempts have been made to forego their use or to present approximations.

For convenience of reference there follows immediately a summation of the several recommendations which have emerged from this investigation.

RECOMMENDATIONS

On the basis of concepts presented in this report, the need for various corrective and beneficial actions is indicated with respect to its primary objective for the development and better use of North Carolina's inland waterways. The lines of approach are open: first, direct measures involving the provision of new, and the improvement of existing, facilities; and second, actions which may promote the general economic well-being of the regions tributary to those waterways, on the assumption that their increased utilization will follow in turn.

Many opportunities in numerous fields have presented themselves where fruitful action is possible. In some instances this action will have to be supplied largely by other than public agencies, although the latter may often lend assistance in certain programs and encourage general trends. Reference to these opportunities has been made in the main body of the report and some are further noted in the final section which is devoted to findings and conclusions. Only those programs which involve specific action by governmental agencies are included in the following recommendations:

1. Establish a Waterway Development Fund, under the administrative jurisdiction of the Department of Conservation and Development, with an annual operating budget in the order of \$500,000; this Fund to be supported by one or more of the following sources of revenue:

- a. Direct allotments from the General Fund.
- b. Allocations from gasoline tax collections commensurate and concurrent with cancellation of present refund privileges now accorded to marine craft use.
- c. Contributions from counties which have direct access to improved and naturally navigable inland waterways. Assessment to be prorated on some equitable basis of population, tax valuation, or small craft registration.
- d. A nominal assessment, analogous to the "Nickels for Know-How" program, on production of commercial fisheries.
- e. Revolving funds such as may result from reimbursement of State expenditures under this program through subsequent Federal Appropriations under the provisions of Section 11 of the River and Harbor Act of March 3, 1925.

2. Based upon advance planning, biennial reports, and interim recommendations of the Department of Conservation and Development, waterway improvement programs supplementary, or in addition to authorized Federal projects, would be supported by the Waterway Development Fund, in accordance with the following general principles:

- a. Only those projects which would result in broad benefits to a variety of interests, over relatively widespread geographical limits in the Coastal Plain, would be eligible for inclusion in the program.

- b. Preference to be given to those projects where relatively small expenditures would result in extensive benefits.
- c. Emergency work of limited magnitude to be undertaken in case where Federal funds are unavailable or intolerable delay is anticipated.
- d. Reasonable amounts to be used for necessary investigations and planning which cannot be otherwise supplied by the Corps of Engineers or other agencies.
- e. All actual construction and field surveys, programmed and supported by the Water Fund, to be done by the Corps of Engineers wherever possible, through allotments from the Fund.
- f. Close liaison to be maintained with the Chief of Engineers and his officers, and members of Congress, so as to enhance in every way the probabilities of a high percentage of eventual reimbursement to the Fund for expenditures made by it, if and when Federal appropriations become available.

3. In accordance with the above basic principals, the following first-year program is recommended:

- a. Initiation of dredging operations on the Federally authorized Manteo Bay to Oregon Inlet 12 to 14-foot Channel Project. Work to be confined to the Inlet proper and to such limited reaches of the 24 miles of channel where the removal of localized shoaling would add materially to the present restricted controlling depth. Recommended allotment - \$150,000.
- b. Initiate work within Drum Inlet proper (with concurrence of Chief of Engineers since this portion lacks Federal authorization) and remove shoaling in the lower end of the existing approach channel - an authorized project. Recommended allotment - \$100,000.
- c. Initiate work on the Masonboro Inlet Channel Project exclusive of the provision of the seaward jetties but removing any localized shoaling in Banks and Motte Channels. Recommended allotment - \$100,000.
- d. Initiate a program for the provision of small harbors of refuge at critical points along the several waterways, after field investigations are made to determine suitable locations where relatively limited dredging operations give promise of material benefits. Recommended allotment - \$75,000.
- e. Lend assistance to the maintenance and deepening of the locally provided opening through the barrier just north of Carolina Beach, which connects Myrtle Sound and the ocean. Also remove localized shoaling in the channel to that community. (This is not a Federally authorized project but is under study with a view to possible adoption.) Recommended allotment - \$25,000.
- f. Emergency dredging, contingencies, investigations, planning and administration. Recommended allotment - \$50,000.

4. In budgeting proposed operations under the Waterway Fund during years subsequent to the initial program recommended above, provision should be made to give some degree of assistance to waterway projects which are more localized in their prospective benefits. These would include delayed Federal projects for the deepening of harbors, municipal mooring basins, and approach channels giving access thereto. Non-Federal approach channels from the outside limits of authorized projects to municipally sponsored terminals, industrial areas or marinas, would be assisted under prescribed degrees of local participation and contributions of not less than 25 per cent, nor more than 75, depending upon the extent to which benefits would be dispersed.

In addition to programs supported or assisted by the Waterway Development Fund the following are recommended:

5. Initiate immediately preliminary economic and engineering studies as to the feasibility of a large export grain terminal, (with provision of Commodity Credit Corporation storage capacity based upon prior lease commitments by that agency) at one of the deep-water ports, with due consideration to back-haul possibilities and in competition with the present outlet through Baltimore, Maryland.

6. Provide for the employment or services of transportation and economic specialists who will be available to advise communities which desire to embark upon municipally sponsored shallow-draft water terminal projects involving barge-loading, grain storage, industrial sites, and other facilities.

7. Encourage, through local agencies, the provision of increased farm and commercial grain storage.

8. Provide advice and technical assistance to coastal communities on clean-up, rehabilitation and beautification programs of waterfront structures and areas in prospective tourist ports.

9. Investigate, and if practicability is indicated, set up a State-owned mobile land clearing unit with suitable heavy equipment (dozers, rooters, trailers, etc.) to serve as a pilot operation on a custom basis to farmers with a view to encouraging similar ventures by private enterprise.

10. Investigate feasibility of State-owned and initially operated mobile drainage unit equipped with heavy ditching machinery for custom operation and to demonstrate and promote similar ventures by private enterprise.

11. Continue and expand the present educational and assistance programs to promote improved grading and marketing of agricultural products.

12. Continue and expand the Test-Farm and other programs for improving farm practices, including better fertilization, seed and stock selection, disease and pest control, crop rotation and diversification.

13. Facilitate, through local organizations, the establishment of produce markets.

14. Continue and expand research projects at the State College and other institutions for the improvement of plant species and their introduction into local practices. Investigate possibility of restoring rice culture on Coastal Plain on basis of complete mechanization as followed elsewhere.

15. Lay particular emphasis on extension and other programs on expanding beef, and dairy herds and other farm stock.

16. Encourage in every possible way the reduction of unduly high prevalence of farm tenancy practices in the Coastal Plain by enactments pertaining to tenure and by facilitating home-ownership programs.

17. Continue and expand educational and assistance programs for better exploitation of farm woodlands including selective cutting, controlled grazing, brush burning and the supply of seedlings.

18. Expand cooperative forest fire control net to include all counties.

19. Inaugurate and continue an extensive research program for the higher utilization of wood-wastes, supported by assessments on the pulpwood and lumber industries and such royalties as may accrue from development of new processes.

20. Continue and expand present research and studies related to commercial fisheries, with additional reference to marketing, oysterbed planting laws, and processing.

21. Initiate rate-structure studies on truck, rail, and water transportation with a view to corrective action before the Interstate Commerce Commission where restrictive or discriminatory schedules on specific movements or classes are presently in effect.

22. Coordinate promotional activities of State agencies with the industrial departments of the major railroads.

23. Set up a traffic bureau, either as a function of the Department of Conservation and Development, or along the lines of that established by the Louisville, Kentucky, Chamber of Commerce, whereby shippers are provided with consolidated less-than-carload transportation schedules over all lines and to numerous points, resulting in greatly expedited shipments at carload-lot rates.

24. Prepare and design promotional data based upon the particular requirements of a specific firm rather than a generalized brochure, and stressing or minimizing the subject matter in accordance with its applicability to the individual industry being contacted.

25. Encourage the establishment by one or more of the larger banking institutions of an industrial department with the services of a qualified specialist on small industry financing in both organizational and subsequent operating stages. Lacking success in such attempts, efforts should be made to make the services of

such a specialist available either as a member of the staff of the Department of Conservation and Development or on a retainer basis through a cooperative arrangement with the many development corporations throughout the State.

26. Continue the present programs in cooperation with Federal agencies relative to domestic and industrial water supply, stream pollution, and beach erosion. Expand the facilities and coordinate present methods of forcibly placing before officials of the Corps of Engineers, and the appropriate committees of Congress, all necessary data and arguments in support of waterway and flood control projects, with a view to their early authorization and/or fund allocation.

27. In conclusion the present survey has indicated the need for some type of coordinating agency which would serve first as a clearing house of information relative to the numerous State activities and programs. Many of these are so closely related that coordination is sometimes as difficult as it is vital. An overall planning function could be assigned to such an agency or its role could be limited to that of collecting information and maintaining liaison with the many public and quasi-public agencies with a view to eliminating duplication and facilitating mass attacks upon pressing problems.

I. THE COASTAL PLAIN—PHYSICAL FEATURES

PHYSIOGRAPHY:- Based upon both economic and physical considerations North Carolina may be conveniently divided into three major physiographic divisions: (a) the MOUNTAIN REGION; (b) the PIEDMONT PLATEAU; and (c) the COASTAL PLAIN. Although the Blue Ridge Mountains and the so-called "Fall Line" provide fairly distinct boundaries, or rather zones between these subdivisions there is some variance among authorities when making regional assignments on the basis of whole counties. Some fix the western limit of the Piedmont at the foothills, whereas others use the summit of the Blue Ridge Mountains as the general line of demarcation. More general agreement is found with respect to the Piedmont-Coastal boundary. Since extensive use is made in the present study of statistics collected and published by various State agencies, particularly the Department of Agriculture, county allocations to the three regions as used by the latter have been adopted herein. County boundaries thus followed approximate the usually accepted physiographic limits except that Yadkin County is assigned to the Mountain Region and Richmond to the Piedmont. The western limit of the Coastal Plain is thus fixed by the western boundaries of the following counties: Scotland, Hoke, Harnett, Johnston, Nash, Halifax, and Northampton. As a result 41 counties have been included in the Coastal Plain, 34 in the Piedmont Plateau and 25 in the Mountain Region.

Bounded on the east by the Blue Ridge Escarpment and rising some 1,500 to 2,500 feet above the Piedmont Plateau, the Mountain Region includes some 6,000 square miles which drain to the west through the highly dissected Great Smokies and their associated cross ridges and chains. The remaining area of approximately 4,000 square miles east of the Blue Ridge summit, also classified as "Mountain" in this report, drains to the Atlantic Ocean. The contouring is in general quite gentle up to an elevation of 6,000 feet with many cultivable slopes and mountain meadows containing deep rich soil.

Based upon the county boundaries used in the present report the Piedmont Plateau has an area of about 16,000 square miles. It is separated from the Coastal Plain by a zone some 30 to 40 miles wide in which interval elevations increase from 200 to 300 feet on the east to 400 or 500 feet above sea level on the west. This, not too distinctly defined zone, is the so-called "Fall Line." From the Fall Line the Piedmont Plateau rises gradually, in well rounded hills and low rolling ridges, to an elevation of approximately 1,500 feet at the foot of the Blue Ridge Escarpment.

The Coastal Plain, as limited herein by county boundaries, includes nearly one half the State - 22,297 of a total of 49,097 square miles. A further natural subdivision might be applied consisting of a gently rolling and well drained inner or western portion as distinguished from the low lying, and in part, swampy outer, or tidewater region. A line through the towns of Gatesville, Plymouth, Washington, New Bern, Jacksonville and Wilmington marks the approximate boundary between these two subdivisions.

GEOLOGY:- The early geology of North Carolina, particularly the western portion, is extremely complex. Present relief in the mountainous region is, in general, the result of a pronounced though more or less uniform elevation of a peneplain, followed by its erosive sculpturing during Cenozoic time. During the relatively recent Tertiary Period the ocean shoreline moved back and forth across the Coastal Plain accumulating sedimentary formations during intervals of submergence. During the succeeding Quarternary Period the Coastal Plain gradually emerged from the ocean by stages. Each of these stages is represented by a broad flat plain or terrace bordered by a definite scarp marking an abandoned shoreline. Examples of these ancient shorelines can be identified today at numerous places in Eastern North Carolina.

CLIMATE:- One of North Carolina's most valuable "Natural Resources" is its generally benign climate. It affects favorably nearly every activity of the State and promises to become an even more critical influence in its future growth and development.

The principal factors affecting North Carolina climate are the high mountain areas in the west and to a lesser degree the Atlantic Ocean and landlocked sounds in the coastal areas. The mountains tend to impede the intrusion of cold air masses from the northwest in winter and in summer they influence rainfall by orographic effect upon moisture laden winds from the south or east. The Gulf Stream, approaching within 12 miles of Cape Hatteras, 23 miles from Cape Lookout and 40 from Cape Fear, has some ameliorating effect but perhaps not so great as commonly believed. Undoubtedly the ocean, plus the large inland sounds and bays, do serve as stabilizing influences. Very little of the variation in climate is caused by differences of latitude within the state, even though its isotherms (lines connecting points of equal mean annual temperature) follow very nearly an east-west direction in the Piedmont and Coastal Regions.

SEASONAL AND REGIONAL AVERAGE TEMPERATURES

REGION	SPRING	SUMMER	AUTUMN	WINTER	ANNUAL
COASTAL	60	77	63	44	62
PIEDMONT	59	77	60	42	61
MOUNTAIN	54	71	56	38	56
STATE	58	75	60	42	59

In the extreme southeast conditions approach semi-tropical with an annual mean of 64 degrees at Southport; a July average of 80.4; a maximum of record of 103 and a minimum of 1.0. Except for less severe extremes on or near the Outer Banks, temperatures for the Tidewater or eastern tier of counties do not vary much more than two or three degrees from those indicated above for Southport.

In the Coastal Plain sub-freezing temperatures arrive late and are usually of short duration. There is no record of zero weather within 20 or 30 miles of the coast and some winters pass without temperatures much below the freezing point

along the southern seaboard. The average date of the first killing frost varies from about October 17 in Northampton County to November 16 in the southeast, with an average growing season of 216 days for the Coastal Plain as a whole.

The average relative humidity for the State is 71 per cent, being slightly higher in the east. Similarly, the overall percentage of possible sunshine varies from about 53 in the winter to 68 in the fall with an average of 61 per cent for the year.

The average rainfall for the State is 50 inches with some fairly wide departures from this norm at various stations, particularly in the western part of the State. In the Coastal Plain average annual precipitation varies from a minimum of 42.48 inches in Currituck County (Wash Woods) to a maximum of 56.15 at New Bern in Craven County which marks a distinct "high" in the isohyetal map of Eastern North Carolina. Average annual precipitation totals drop off rapidly in all directions from this center. Seasonal variation is very favorable to agriculture yet sufficiently well distributed throughout the year to maintain good stream flows for water supply. The lighter rains occur during the fall harvesting months whereas the highest frequency rates and greatest monthly totals come in July and August, often as afternoon thunderstorms. Droughts are rare although that of 1953 was widespread and quite severe in some localities.

Snowfall is generally light (one to 4 inches) and during some years absent in the Coastal areas except in the northwestern counties - Northampton, Halifax, etc. Even in the upper watersheds of the main streams and their tributaries sudden snow melts are relatively unimportant in producing spring floods.

Storms accompanied by high wind velocities are of critical importance to the Coastal areas, not only in their direct tidal and hazard effects upon marine activities but also with respect to the stability of shorelines, channels, access inlets and beach properties. Cape Hatteras waters have earned their dubious reputation.

The prevailing wind is from the southwest. Occasional tropical storms of hurricane intensity subject the Coastal areas to heavy rains and dangerous winds. During the 70 year period (1876-1946) 76 such tropical hurricanes touched or approached within 150 miles of the eastern coastline. Half of these occurred in the interval June 1 to September 15 and the remainder from September 16 to November 30. Records of the Weather Bureau at Hatteras for the 25 year period (1911-1935) list 52 storms of all types with wind velocities of over 45 miles per hour. During thirty of these storms winds were from the north or northwest. Although 13 of the 52 storms occurred during the month of March higher average wind velocities occurred during the 6 storms listed for September. The highest recorded velocity occurred during the September, 1944 storm, when northeast winds reached intensities of 110 miles per hour for short intervals ("Fastest Mile"). Much lower maxima have been recorded at other coastal stations. For instance, a "Fastest Mile" for Wilmington of 65 m/hr. from the east, is the extreme for that station (Feb., 1953).

CONTINENTAL SHELF AND OFFSHORE WATERS:- The ocean depths, temperatures and currents immediately off the eastern shores of North Carolina have considerable influence upon one of the Coastal Plain's principal industries - its fisheries.

The true edge of a continental mass is, as a rule, at some distance from the visible shoreline. Off North Carolina, this so-called continental shelf slopes gradually from the coast to about the 100-fathom line, where it drops off rather abruptly to the deep ocean basin. Available information indicates that most deep-sea fishery resources are to be found within these shelf waters.

The 100-fathom contour lies about 78 miles offshore on a prolongation of the South Carolina boundary. From here it follows a fairly uniform northeast direction to a point about 21 miles off Cape Hatteras. Here it turns due north and passes the Virginia line some 64 miles to sea. These boundaries enclose an area of over 14,000 square miles of comparatively shallow water. Although there has been but limited detailed mapping of the outer areas, depths over the prominent inner shoals, such as Diamond, Cape Lookout, Frying Pan and those off Cape Fear, are well established.

The ocean bottoms are somewhat more sandy near the shore than in the outer areas where finer depositions prevail, interspersed with rough bottoms due to shell accumulations. South of Cape Hatteras, and particularly at the deeper depths, scattered rock formations, including ancient coral heads, are encountered. These rock patches and the sketchy information as to their locations has discouraged fish trawlers from working these promising grounds. Further soundings and studies, particularly of the deeper areas, are needed if the potentialities of the outer shelf are to be fully developed.

From Florida to Cape Hatteras the western margin of the Gulf Stream (in this sector it is referred to as the Florida Current) follows the edge of the Continental shelf or 100-fathom line quite closely. Beyond Hatteras it continues in this same northeast direction thus diverging from the shelf line. The inner edge lies about 35 miles southeast of Cape Fear Light but approaches within 10 or 12 miles of Cape Hatteras. Its axis of maximum strength lies some 40 to 25 miles, respectively, further seaward from these capes. The depth of the stream off North Carolina is about 450 feet, increasing somewhat as it continues to the northeast.

Shoreward from the Gulf Stream the shelf waters have a complex circulation as the net result of various interacting forces including winds, tides and inlet discharge. These are deserving of extensive further studies, if many problems related to fisheries, beach erosion and navigation are to be solved. Similarly much more information is needed with respect to water temperature gradients and seasonal variability. The relationship of the recently discovered wintering populations of fish and other marine forms off Hatteras indicates this area is not only a temperature barrier to fish migration but also a center of dispersal for many valuable species.

The mean tidal range along the outer coast varies from 3.6 feet at Currituck

Beach Light and Cape Hatteras to 4.5 feet at Cape Fear. The spring tide ranges are about 20 per cent higher; whereas at the several open inlets both mean and spring ranges are somewhat lower. Observed tidal current velocities through the inlets vary from 1.4 knots for an average tide through Ocracoke to 2.6 knots at Beaufort Inlet during spring tides.

THE OUTER BANKS:- Perhaps no other single factor has, or will have, more influence upon the social and economic development of Eastern North Carolina than the land and water conformations of its Coastal Plain. Although successive subsidence and uplift of these maritime regions, during recent geological time, have been largely responsible for interior shorelines, the Outer Banks or barrier reefs have given permanence and character to the protected water expanses and their marginal areas.

The outer shoreline has a length of 330 miles, almost all of which consists of barrier reefs or beaches separated from the mainland by lagoons or sounds. Although nearly continuous, this barrier is broken by many tidal inlets which connect the inner waters with the ocean. The inlets have a long history of migration, closure, and reopening. Severe storms frequently breach these barriers, even though they may be from a few hundred feet to several miles wide. They are composed principally of sand with, in some reaches, dunes averaging from 10 to 20 feet in height and a few exceeding 75 feet up to a maximum height of 168 feet.

Test samples from the beaches show varying mixtures of sand and shell. Available evidence is not conclusive as to the source of this sand although considerable research has been made during recent years on this problem in connection with the development of preventative measures against serious beach erosion at many points along the coast. There is a general southward littoral drift from as far north as Cape Henry, Va.; however, some authorities doubt that these extensive barriers could have resulted entirely from such long distant displacements. There is evidence that they have been formed in comparatively recent times from material reworked from other deposits in the vicinity, through wave action and displacement by tidal and fresh water currents, storms and other interacting forces.

A widely accepted theory (proposed by Abbe - 1895) attempting to explain the littoral drift and southwestward migration of inlets, is related to the peculiar cusped shoreline of North Carolina and the hypothetical counterclockwise back eddies of the offshore Gulf Stream which lie within these three well defined cusps. However, much further investigation will be necessary before the complex circulation of these currents and their effects can be evaluated. That the present attenuated offshore bars of loose shifting sand continue to exist is evidence of the persistency of the dynamic forces that built them.

Many of these Outer Banks were once well wooded or grassed over, even during historic times, but they are now generally denuded, resulting in decreased stability and shifting of the dunes. In recent years various measures, such as sand fences and native grass planting, have been tried and, in some cases, with considerable success, as in the Kitty Hawk memorial area.

Since the inlets are the only waterway connections between the ocean and sounds, and are important elements in maintaining proper conditions of salinity required for optimum propagation of both shell and food fish in the interior water, the condition and permanency of these inlets is of vital importance to the present and future economy of the Coastal Plain.

The principal factors affecting the opening, migration and closing of inlets are:

- a. Lunar tides and their amplitudes.
- b. Wind tides with sudden shifting of waters from the landward to the seaward side of the interior sounds.
- c. Direction and strength of frontal wave attack during severe storms.
- d. Littoral currents with alongshore drift of debris.
- e. Discharge volume from interior drainage basins supplementing ebb tide flow and sediments carried thereby.
- f. Area and depth of adjoining sounds affecting their capacities as tidal water reservoirs.
- g. Relative proximity of headlands as shoreline anchors and their role as accumulators and redistributors of littoral drift.

The relative importance of the above factors may vary considerably in specific instances and in any case the interrelationships are too complex for adequate treatment here. However, at some risk of oversimplification, the following general observations are in order:

- a. Inlets are usually opened by storms either through frontal attack or by the sudden build-up of wind tides and waves against the seaward shores of the broader sounds.
- b. Tidal flow, augmented by watershed discharge during ebb flow, tend to keep inlets open. This effect is correspondingly reduced if additional nearby inlets develop, thus diverting part of the total flow. This reversing flow tends to build up submerged tidal deltas at both the ocean and sound ends of the inlet gorge.
- c. Inlets may close suddenly as the result of severe storms which cause major displacements of material, or gradually through an excess of littoral drift over the capacity of inlet flow to cut through the debris moving across the seaward opening.

A theory developed by Dr. D. W. Johnson with respect to shoreline processes appears to be consistent, not only with the frequency of inlet occurrence, but also with respect to the general configuration of the Outer Banks and their abutting sounds and lagoons. The theory assigns an important role to the four major headlands (Capes Henry, Hatteras, Lookout and Fear) as stable sources, or rather reservoirs, of shore building materials. Without discussing its complexities the theory would perhaps account for the fact that beginning at the Virginia line the North Carolina coast has at present but one natural open inlet (Oregon) in the first 100 miles down to Cape Hatteras; six (Hatteras, Ocracoke, Sand Island, Drum, Barden and Beaufort) in the next 100 miles; twelve (Bogue, Bear, Brown's, New

River, New Topsail, Old Topsail, Rich, Mason, Moore, Masonboro, Corncake and Cape Fear River) in the third 100 miles; and five (Lockwoods Folly, Shallotte, Tubbs, Mad and Little River) in the remaining 30 miles to the South Carolina boundary.

In addition to the 24 inlets listed above as now open, old charts dating as far back as 1585 (Hariot) show at least 17 others with varied records of opening and closing, usually as a result of major storms. In fact, over this extended period, only three in the reach from Cape Henry to Cape Lookout - Oregon, Hatteras, and Ocracoke - have remained open at all times. Also, as evidenced where reliable survey data is available, the inlets tend to migrate, usually down coast toward the south and west. Oregon Inlet moved some 7000 feet in the 66 year period of 1850-1916. Marked beach and offshore changes have gone on concurrently with extensive areas of erosion and accretion. Typical of these changes is New Inlet - about 10 miles south of Oregon. After being open for many years, it was closed by a storm in January 1922. An attempt was made to reopen it artificially in 1924 but it remained open for only a few months. It was again reopened by the storm of March 6, 1932. During the next few years it migrated about one-half mile, by successive southward shifts, with concurrent changes in width of opening until by 1947 it had again closed entirely.

It is evident from the above that attempts to dredge new, or maintain old inlets, may be in direct opposition to intensive and usually unpredictable natural forces. Up to the present no attempts have been made to stabilize these inlets by jetties, although there is a recommended and authorized Federal project to construct such levees seaward of Masonboro Inlet at a 1949 estimated cost of \$1,590,000, provided it proves impractical to maintain the bar channel by dredging alone. Also, it might be noted, that in 1952 local interest expended some \$18,000 to dredge a small connecting channel through the barrier between Myrtle Sound and the ocean, about 3 miles north of Carolina Beach. This 6 foot channel was extended seaward from the low water line by blasting operations at the beginning of ebb tide so as to obtain maximum scour through the ocean bar. At last reports depths through the barrier cut appear to be holding well; however, some shoaling has occurred in the ocean bar section and local interests are presently planning to use a drag or plow on a tow line in an attempt to concentrate the flow into these cross-bar pilot channels. In addition to providing passage for small boats the cut was intended to restore salinity conditions in Myrtle Sound in connection with shellfish propagation.

THE SOUNDS AND ESTUARIES:- Shorelines composed of sandy barrier beaches, with narrow lagoons immediately landward thereof, are relatively common; however, the occurrence of broad sounds behind these barriers, or Outer Banks, as encountered along the northeastern coast of North Carolina are exceptional. A suggested explanation (Johnson, 1919) is based upon an assumed emergent outer shoreline coupled with subsequent inshore submergence, the sounds and estuaries representing drowned valleys.

In any case the deeply indented and multiple coastline has had a very important bearing upon the economy of Eastern North Carolina. These expansive pro-

tected waters have determined, in large measure, its means of livelihood, affected its soils and weather, influenced its social structure and dominated the evolution of its communications network.

Beginning at the north, Currituck Sound has an area of about 160 square miles including Back Bay, which is an arm extending beyond the Virginia boundary. It is about 40 miles long, 3 to 4 miles wide and less than 7 feet deep over most of the area except within the artificial channels of the Atlantic Intracoastal Waterway. This waterway traverses the entire length of Currituck Sound and connects it with the Norfolk area by way of the Albemarle and Chesapeake Route of the Intracoastal Waterway. The nearest ocean connection is Oregon Inlet, some 24 miles below the southern mouth of the sound; consequently it is essentially a fresh water body draining the bordering swamps and lowlands. The canal connection to Norfolk was originally provided with a salt-water lock but this was removed in 1913 resulting in higher salinities and a pollution threat. Protests by local interests based upon these threats to fresh water game fishes and related forms were largely responsible for the construction, by the Federal Government, of a new guard lock at Great Bridge in 1932.

Albemarle Sound is the sunken valley of the Roanoke River, which evidently once flowed to the sea past the present location of Nags Head. The barrier beach along this reach of the coast was thrown up at a later period to form Roanoke and Currituck Sounds. Albemarle Sound has a surface area of over 500 square miles. It extends some 55 miles in an east-west direction, averaging about 7 miles wide, and with fairly uniform depths of 17 to 20 feet. Its large drainage area of over 10,000 square miles, including the Roanoke, Chowan, Perquimans, Little, Pasquotank, North and Alligator Rivers, plus the Currituck Sound watersheds, and its indirect ocean connections give Albemarle Sound essentially fresh water characteristics favorable to anadromous fish spawning and migration.

Croatan and the more recently enclosed Roanoke Sound are separated by Roanoke Island to form parallel connecting channels from Albemarle to the northern end of Pamlico Sound and the adjacent Oregon Inlet. Croatan and Roanoke Sounds are relatively small in area - about 35 and 25 square miles, respectively. Though of equal length - 8 miles - Croatan is both wider (2 to 4 miles) and deeper (7 to 10 feet) than Roanoke (1/2 to 2 miles and 1 to 3 feet). Consequent greater flows through the former and higher salinities in the latter affect their relative suitability for migratory fish and oyster production.

Pamlico, with over 1700 square miles of surface area, is by far the largest of the sounds. It extends some 70 miles in its longest northeast-southwest dimension and varies from 10 to 30 miles in width. Outside of its extensive shoal areas it has a fairly uniform depth of about 20 feet. The shoals occur along the entire shoreline, merging into the bordering marshes; as submerged deltas at the four existing inlets; between the converging mouths of rivers, particularly the Neuse and Pamlico; and at Bluff Shoals which extends northward from Ocracoke, forming a deposition zone between the merging waters of Albemarle and Pamlico Sounds. The salinity of Pamlico Sound waters varies greatly with time and location thus materially affecting the prevalence and distribution of its many marine forms.

Core Sound (120 square miles) joins the southern end of Pamlico Sound a few miles north of Drum Inlet and extends southwesterly about 36 miles to the vicinity of Beaufort. It varies from 1 to 6 miles in width and is extremely shoal, averaging about 3 1/2 feet in depth. This sound has access to the ocean through 2 inlets, and although it receives considerable runoff from the adjacent lowlands, its average salinity is fairly high. After gradually closing, over a period of many years, Drum Inlet was reopened by a storm in September of 1933. After a long period of study and as a result of solicitation on the part of local fishing interests, a 5 by 50 foot channel was dredged in 1937 by the Federal Government, connecting the southern end of Core Sound with Lookout Bight, at a cost of \$25,000. This channel is known variously as The Drain or Barden Inlet. Considerable maintenance dredging has been required to keep this inlet open during subsequent years.

Bogue Sound extends westward some 25 miles from Beaufort to New River Inlet, with a surface area of approximately 35 square miles. It is comparatively narrow and shallow, averaging less than 2 1/2 feet except within the artificial channels of the Intracoastal Waterway which traverses the entire length of the sound close to its northern shore. There are 3 open inlets near the western end of the sound - Bogue, Bear and Brown's.

Continuing south to Cape Fear River the coast is fringed with numerous small, shallow lagoons interrupted by marshes. Drainage channels of varying size empty into these so-called sounds and several inlets connect them with the ocean; the largest of these is New River and its inlet. The larger lagoons are Stump Sound, Topsail, Middle, Masonboro, and just north of Cape Fear, Myrtle Sound. There is very little open lagoon water in the next 32 miles to Little River Inlet at the South Carolina boundary.

Available current and related data affecting circulation of water in the several sounds and inlets are inadequate to serve as bases for other than the following general observations:

- a. Lunar tides are negligible factors except in the immediate vicinity of inlets where tidal currents may reach spring maxima of 2.6 knots, as at Beaufort Inlet.
- b. Wind force and direction are the major current and stage producing factors. Wind-driven water may range about 2 feet above and below normal in the open sounds. The funneling of this water into narrowing river mouths, such as occurs at Washington or New Bern, may result in wind tides of 3 or 4 feet above normal.
- c. Insufficient or inapplicable data prevent reliable quantitative correlation with respect to stream inflow into the sounds, inlet discharge, evaporation, transpiration and rainfall over the sound areas. As to the relative importance of these factors the Corps of Engineers used the following daily values in recent studies:- discharge into Albemarle, Pamlico, and Core Sounds - 44,464 acre-feet; evaporation (based on observations as Lake Michie, Durham, N. C.) - 25,392 acre-feet; net inflow - 19,072 acre-feet. No estimates as to rainfall below the gaging stations or transpiration are given. In any case the

net inflow to these sounds appears relatively minor in view of their combined surface area of over one million acres.

Storm winds and waves on the sounds can become serious threats to the smaller fishing and pleasure craft plying these waters. Similar hazards, with frequent extensive damage, are experienced at the more exposed inland ports and boat basins, particularly when wind directions coincide with the longer fetches. Many of the requests of local communities for Federal aid are based upon their need to alleviate these recurrent damages, as at Belhaven and Oriental.

MAJOR DRAINAGE SYSTEMS:- Eastern North Carolina has 6 principal drainage areas:

- a. MEHERRIN-CHOWAN BASIN:- Part of this lies north of the Virginia boundary, but with 1175 square miles within the State.
- b. ROANOKE-DAN BASIN:- Total area - 9630 square miles with 3330 in North Carolina.
- c. TAR RIVER BASIN:- Drainage area above Washington, N. C. , 3075 square miles, all within the State.
- d. NEUSE RIVER BASIN:- Drainage area above a point about 10 miles below New Bern - 4450 square miles, all within the State.
- e. CAPE FEAR BASIN:- Drainage area above Wilmington - 8500 square miles, all within the State.
- f. YADKIN RIVER BASIN:- Of the 41 Coastal Plain counties only Scotland, Robeson and a part of Hoke drain into the Yadkin River System (Known as the Pee Dee in South Carolina).

In addition to these 6 basins there is the so-called Tidewater area along the coast, which drains directly into the ocean or its adjacent sounds and lagoons. Much of this area is comprised of lowlands or marshes in contrast to the higher and gently rolling inner Coastal Plain. This Tidewater region has a land area of over 6000 square miles, about 70 per cent of which is classified as forested as compared to about 60 per cent for the higher lands of the western portion of the Coastal Plain. The percentage of acreage actually tilled and harvested in the Tidewater area, as compared to that in the inner Coastal Plain, shows even greater disparity, being about 11 and 27 per cent respectively. One county, Dare, is reported (1950 census) to have but 132 acres in harvested crops, whereas Lenoir, an inner Coastal Plain county, has about 42 per cent of its total land area under cultivation. (See Table No. I-1).

In contrast to the coastal lowlands with land elevations down to, or even below sea level, the inner areas are, in general, well drained. A few river valleys are subject to serious flood threats such as the Cape Fear, where 75 foot stages have been reported, the Neuse, and formerly along the Roanoke until the completion, in 1953, of the \$37,000,000 John H. Kerr Dam, some 18 miles upstream from the North Carolina-Virginia boundary. This multiple purpose (power, stream regulation and flood control) project provides 1,278,000 acre-feet specifically reserved for flood storage, or nearly one half the total reservoir capacity. The dam, operated as a unit with the upstream Philpott Project, now essentially com-

TABLE NO. 1-1

LAND USE IN COASTAL PLAIN - U. S. CENSUS 1950

COUNTY	LAND AREA. ACRES	IN FOR- ESTS. ACRES	PER CENT FOR- ESTED	LAND IN FARMS				
				TOTAL ACRES	% OF TOTAL	HARVESTED ACRES	PASTURED ACRES	WOODLAND ACRES
Beaufort	531,840	370,300	69.6	256,796	48.3	99,172	24,079	108,072
Bertie	443,520	302,900	68.3	273,536	61.7	80,251	16,794	164,479
Bladen	562,560	516,800	91.9	288,685	51.3	67,814	36,340	165,082
Brunswick	558,720	427,200	76.5	158,857	28.4	30,016	16,328	101,379
Camden	152,960	85,100	55.6	64,437	42.1	31,215	4,522	24,719
Carteret	340,480	273,000	80.2	57,015	16.7	11,368	17,455	22,571
Chowan	115,200	43,300	37.6	77,885	67.6	31,708	6,803	35,325
Columbus	600,960	468,800	78.0	325,909	54.2	107,550	22,710	172,233
Craven	464,000	328,100	70.7	174,521	37.6	49,794	22,389	88,517
Cumberland	423,040	284,400	67.2	234,959	55.5	86,293	19,314	107,716
Currituck	174,720	84,800	48.5	73,507	42.1	29,188	8,157	28,214
Dare	248,320	166,300	67.0	1,619	0.7	132	238	1,068
Duplin	526,080	334,200	63.5	360,377	68.5	122,091	34,079	173,915
Edgecombe	309,056	145,261	47.0	274,363	83.9	120,485	22,776	111,779
Gates	219,520	169,100	77.0	116,061	52.9	36,631	13,595	60,813
Greene	172,160	68,700	40.0	144,642	84.0	69,302	8,358	59,037
Halifax	462,080	197,900	42.8	373,531	80.8	134,433	34,239	180,622
Harnett	387,840	232,200	59.9	292,255	75.4	110,189	23,897	129,248
Hertford	227,840	139,000	61.0	140,714	61.8	50,010	9,896	73,224
Hoke	264,960	178,900	67.5	133,875	50.5	55,574	6,172	60,643
Hyde	405,760	295,000	72.7	65,623	16.2	30,244	6,165	20,873
Johnston	508,000	236,500	46.6	417,588	82.1	181,083	47,159	164,194
Jones	298,880	200,500	67.1	128,873	43.1	41,144	8,565	72,714
Lenoir	250,240	128,700	51.4	230,286	92.0	93,033	18,458	103,060
Martin	307,840	174,100	56.6	211,142	68.6	71,635	17,225	116,559
Nash	353,280	157,200	44.5	311,598	88.2	120,590	25,832	146,701
New Hanover	124,160	101,500	81.7	28,370	22.8	7,655	1,858	14,090
Northampton	345,600	162,600	47.0	295,358	85.5	114,183	26,197	133,806
Onslow	483,840	366,600	75.8	154,718	32.0	44,433	14,209	81,934
Pamlico	218,240	149,900	68.7	70,331	32.2	27,080	3,672	33,480
Pasquotank	146,560	64,800	44.2	80,253	54.8	43,903	7,031	22,475
Pender	548,480	401,000	73.1	157,014	28.6	38,149	14,618	88,418
Perquimans	167,040	93,100	55.7	100,265	60.0	44,129	9,903	40,630
Pitt	419,840	185,600	44.2	311,302	74.1	142,476	24,999	126,838
Robeson	604,160	343,600	56.9	451,001	74.6	220,817	24,951	183,662
Sampson	616,320	338,700	55.0	443,349	71.9	164,994	26,519	227,539
Scotland	202,880	124,300	61.3	139,033	68.5	64,091	13,416	50,920
Tyrrell	255,360	221,600	86.8	40,378	15.8	16,641	3,509	16,804
Washington	215,040	152,500	71.0	72,368	33.7	27,519	6,107	32,759
Wayne	355,200	168,100	47.3	290,887	81.9	137,386	22,485	112,981
Wilson	238,720	93,100	39.0	206,605	86.5	99,567	10,548	84,899
TOTAL, OR AVERAGE	14,251,296	8,975,261	63.0	8,029,886	56.3	3,053,968	681,567	3,743,992

plete, should largely eliminate recurrent flood damages along the Roanoke River in this State.

Although ground water observations are limited, this source of supply appears adequate for any demands which may be placed upon it for a considerable period in the future. Existing stream discharge records are generally of less than 25 years duration. The following locations of the lowest gaging stations usually leave considerable down stream areas outside the controlled drainage:- near Scotland Neck (about 100 above the mouth) on the Roanoke; Tarboro (87 miles above the mouth of the Pamlico River) on the Tar; Kinston (84 miles above the mouth) on the Neuse; and Lock No. 3 (123 miles above the mouth) on the Cape Fear. These two factors - duration of record and gaging station location - permit of only general analyses with regard to the means and extremes of watershed runoff within the Coastal Plain.

River bank erosion is not a serious problem in Eastern North Carolina. However soil erosion has been and continues to be a real threat with large scale corrective measures, for this and related conditions, needed on thousands of acres of the Coastal Plain's inner zone. On the other hand drainage is the important factor over most of the Tidewater portion, if large tracts of potentially valuable crop and pasture lands within that area are to be brought into production.

II. POPULATION CHARACTERISTICS

It should be noted that all data contained in this report pertaining to population characteristics, including economic statistics, such as employment status and agricultural production, are, unless otherwise identified, taken from the latest (1950) U. S. Bureau of the Census publications. As such, these data are subject to the numerous qualifications, definitions and explanatory remarks as contained in these official documents. The restrictive interpretations are particularly important with respect to urban, rural and farm populations, income sources and brackets, labor force composition and land use. For instance, the 1950 definition of urban residence has been changed by the Bureau from that applicable in 1940. (Persons living in both incorporated and unincorporated places of 2500 or more inhabitants and all those living within the densely settled "fringe" areas of cities of over 50,000, are now classed as urban). Due caution should therefore be exercised in the interpretation of all such data, since it will be impractical to include the Bureau's rather extensive explanatory remarks usually applicable to the numerous statistical presentations subsequently appearing in this report.

Comparative analyses of North Carolina population statistics reveal trends with respect to the economy of the Coastal Plain and particularly the eastern tier of Tidewater counties. The lesser densities and general lack of urban concentrations in both Mountain and Coastal regions are well illustrated by Plate II and Table No. II-1.

By the time of the 1890 census the Piedmont Plateau had largely overcome the early predominance of the Coastal Plain; not only in population gains, but in economic, sociological and political matters as well. Since then each decade has continued this trend, which, in so far as population increases are concerned, is indicated by Table No. II-2. Data from this latter table were used in preparing Graph No. II-1.

In order to give emphasis to those areas having retarded growth rates Table II-1 was prepared in which the 100 counties of the State are arranged in the reverse order of their respective rates of increase during the last census decade (1940-1950). Also listed in the table are: growth rate percentages for each decade since 1910; the same for the 60 year period since 1890; physiographic subdivision, i. e., Coastal, Piedmont or Mountain; inhabitants per square mile in 1950; and percentages of farm, urban and non-white populations. With a few exceptions there appears to be some degree of consistency between recent increase rates and other regional population characteristics. Of the 76 counties which experienced a 1940-50 growth rate below that for the State as a whole (13.7 per cent) 34 of the 41 Coastal Plain counties and 20 of the 25 Mountain counties are in this below-average group, whereas only 22 of the 34 Piedmont counties are so classified. The disparity would be even more evident except for recent abnormal conditions in three Coastal Plain counties - Onslow, Cumberland and Craven - which enjoyed higher growth rates (134.4; 61.8 and 56.0 per cent respectively) than every one of the other 97 counties of the State. However, in each of these three cases almost the entire increase can be accounted for by the influx of service personnel and attendant expansion on and near the big military establishments at Camp

Lejeune, Fort Bragg and Cherry Point Marine Air Base, respectively.

Of the 22 counties which lost population during the last census decade only three were in the Piedmont and except for two of these three no county of the 22 held a town of 2500 inhabitants or over; in other words, the remaining 20 were without populations classed as urban. As to the 41 Coastal Plain counties only 24 contain one of the 30 towns with populations of 2500 or over located in that area. (See Table No. II-3). In fact there are but nine cities in the entire Coastal Plain with populations in excess of 10,000; the largest being Wilmington with 45,043 inhabitants as of 1950.

The growth rates listed below for these nine principal Coastal Plain cities during recent decades is of interest. The much higher percentage increases of these cities, in contrast to corresponding rates experienced by the region as a whole, is indicative of pronounced urbanization trends.

CITY	PERCENTAGE INCREASE FOR EACH DECADE ENDING						
	1950	1940	1930	1920	1910	1900	1890
Wilmington	34.8	3.5	-3.3	29.6	22.7	4.6	15.6
Fayetteville	99.2	33.6	47.0	26.0	50.9	10.6	21.1
Rocky Mount	8.3	19.4	68.0	58.3	174.1	259.9	47.8
Wilson	19.6	52.5	18.9	58.0	90.6	65.8	44.1
Goldsboro	24.2	15.3	32.7	85.0	3.9	46.3	22.2
Kinston	19.2	35.4	16.3	39.7	70.4	137.9	41.9
Greenville	32.0	37.9	59.3	40.7	59.9	32.4	112.4
New Bern	33.8	-1.4	-1.8	22.5	9.6	15.9	21.7
Elizabeth City	9.7	15.2	12.5	6.1	32.5	95.3	40.4

In brief, Eastern North Carolina is a region of small towns and relatively high percentages of rural and farm populations. Exclusive of a few exceptional cases, such as Dare County with 1.4 and New Hanover with 2.7 per cent, farm populations range from about 40 to a maximum of 83 per cent (Greene County). This is particularly true of the old cotton and tobacco belt where tenant farming is relatively common. With 45.4 per cent of the State's total land area the Coastal Plain had, in 1950, but 34.5 per cent of the population as compared to 48.6 per cent in the Piedmont Plateau. The 60 year trend is even more significant in view of the slow but consistent decrease from a percentage of 38.3 for the former in 1890 as compared to 42.9 for the latter.

Another outstanding characteristic is the extremely high percentage (99.603) of North Carolina's U. S. native-born population. In this respect it ranks third among the 48 states, surpassed only by Mississippi with 99.618 per cent and South Carolina with 99.645. Although exact data are unavailable undoubtedly the Coastal areas would show even higher percentages. Similarly, with a few exceptions, Coastal Plain counties have higher ratios of non-white inhabitants than the average (26.6%) for the State as a whole.

Available statistics indicate a serious imbalance between immigration into

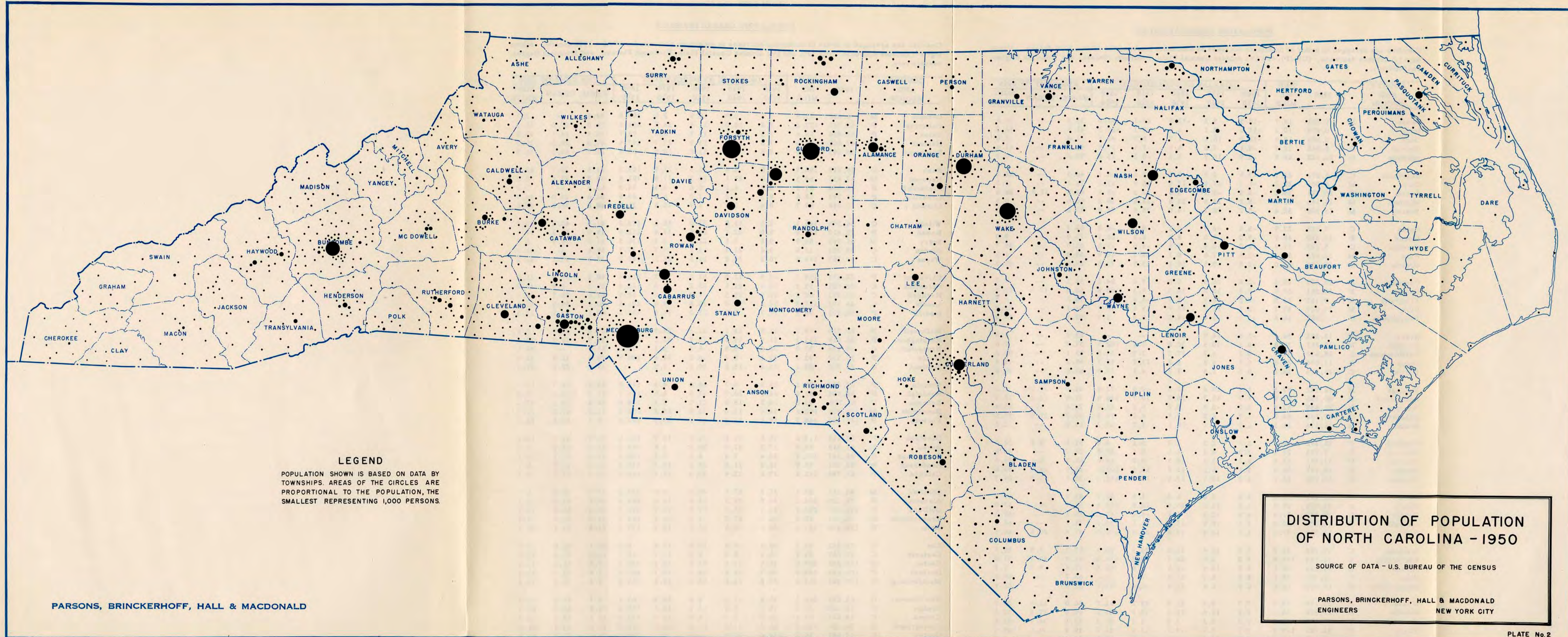


TABLE NO. II-1

POPULATION CHARACTERISTICS

Counties are arranged in order of maximum decrease to maximum increase for 1940 - 1950 decade. Minus sign (-) denotes decrease. (C), (P), and (M) denotes Coastal Plain, Piedmont Plateau, and Mountain Region, respectively.

COUNTY AND REGION		1950	PER SQ. MILE	INCREASE BY PERCENTAGE					PER CENT OF 1950		
				1940 1950	1930 1940	1920 1930	1910 1920	1890 1950	FARM	URBAN	NON- WHITE
Swain	M	9,921	18.7	-18.5	5.3	-12.5	27.1	51.0	53.4	--	15.6
Hyde	C	6,479	10.2	-17.6	-8.1	2.0	-5.1	-27.3	41.6	--	42.2
Dare	C	5,405	13.9	-10.5	16.1	1.7	5.7	43.5	1.4	--	7.0
Tyrrell	C	5,048	12.7	-9.1	7.6	6.5	-7.1	19.5	43.8	--	41.4
Madison	M	20,522	45.0	-8.9	10.9	1.1	-0.2	15.2	72.2	--	0.9
Currituck	C	6,201	22.7	-7.6	0.0	-7.7	-5.5	-8.1	46.3	--	32.0
Clay	M	6,006	28.2	-6.2	17.9	17.0	18.9	43.1	72.1	--	1.1
Anson	P	26,781	50.2	-5.8	-3.1	3.6	11.3	33.8	47.8	12.7	48.6
Mitchell	M	15,143	68.8	-5.2	14.5	23.8	-34.6	18.2	60.6	--	0.3
Yancey	M	16,306	52.4	-5.2	18.7	-4.0	25.0	71.8	73.2	--	1.1
Gates	C	9,555	27.9	-5.0	-4.7	0.1	0.8	-6.8	60.7	--	52.6
Stokes	P	21,520	46.9	-5.0	1.6	8.3	2.1	25.1	73.9	--	9.0
Camden	C	5,223	21.9	-4.0	-0.4	1.5	-4.6	-7.8	43.0	--	38.7
Ashe	M	21,878	51.2	-3.5	7.8	0.1	10.1	40.0	80.8	--	1.3
Greene	C	18,024	67.0	-2.8	-0.6	15.1	23.9	79.5	82.6	--	46.5
Cherokee	M	18,294	40.3	-2.8	16.5	6.0	7.8	84.4	53.3	--	1.7
Person	P	24,361	60.9	-2.7	13.6	16.2	9.3	60.8	60.0	17.7	36.2
Alleghany	M	8,155	35.5	-2.2	16.1	-2.9	-4.4	25.0	78.6	--	3.3
Polk	M	11,627	49.7	-2.1	16.2	15.7	15.6	96.9	44.1	--	13.0
Perquimans	C	9,602	36.8	-1.7	-8.4	-4.2	0.8	3.3	40.6	--	47.8
Avery	M	13,352	54.1	-1.5	14.9	14.2	--	--	63.3	--	1.5
Jackson	M	19,261	38.8	-0.5	10.5	30.8	3.1	102.5	57.7	--	7.6
Northampton	C	28,432	52.7	0.5	4.2	17.2	3.9	33.8	63.1	--	64.2
Jones	C	11,004	23.6	0.7	4.8	5.2	13.7	48.7	69.2	--	45.4
Bertie	C	26,439	38.2	0.9	1.4	7.7	4.1	37.9	63.6	--	59.8
Watauga	M	18,342	57.3	1.3	19.4	12.5	-0.6	72.8	64.2	16.2	1.2
Rutherford	M	46,356	81.9	1.7	12.7	28.7	10.7	146.6	35.6	33.4	12.3
Warren	P	23,539	52.9	1.7	-0.9	8.2	6.5	21.6	72.4	--	66.4
Beaufort	C	37,134	44.7	1.9	4.0	7.7	4.1	76.2	39.7	32.9	37.3
Macon	M	16,174	31.3	1.9	16.1	6.1	5.7	60.2	63.0	--	2.2
Chatham	P	25,392	35.9	2.7	2.3	1.5	5.2	0.0	51.5	9.8	32.1
Pamlico	C	9,993	29.3	3.0	4.4	2.6	-9.1	39.9	28.7	--	34.6
Franklin	P	31,341	63.4	3.2	3.1	10.5	8.0	48.6	66.9	8.1	45.6
Halifax	C	58,377	80.9	3.3	6.1	21.7	16.3	102.0	45.9	24.1	56.6
Johnston	C	65,906	82.9	3.3	10.7	17.6	18.3	142.2	58.8	12.5	21.7
Davie	P	15,420	58.4	3.4	3.6	6.0	1.4	32.7	43.9	--	14.0
Duplin	C	41,074	50.0	3.4	13.2	16.1	18.8	119.3	65.7	--	37.0
Pender	C	18,423	21.5	4.0	12.9	6.1	-4.4	47.2	58.2	--	48.3
Caswell	P	20,870	48.0	4.2	10.0	15.6	6.1	30.1	74.7	--	47.6
Pitt	C	63,789	97.2	4.2	12.4	19.5	25.4	150.0	47.4	30.8	46.3
Sampson	C	49,780	51.7	4.9	18.4	11.3	20.1	98.4	67.3	8.9	36.8
Edgecombe	C	51,634	101.0	5.0	2.6	26.1	18.7	114.2	42.3	40.7	51.9
Wilkes	M	45,243	59.1	5.2	18.9	10.8	7.8	60.4	50.9	9.7	6.0
Hoke	C	15,756	38.1	5.5	4.9	21.5	--	--	62.7	--	60.6
Montgomery	P	17,260	35.4	6.0	0.4	11.0	-2.4	53.5	33.5	--	22.9
Moore	P	33,129	49.3	7.0	9.8	31.9	25.7	61.7	36.0	12.9	26.9
Martin	C	27,938	58.1	7.0	11.6	12.3	17.0	83.6	57.4	17.8	50.4
Washington	C	13,180	39.2	7.0	6.2	1.5	3.3	29.2	37.1	34.0	43.6
Vance	P	32,101	119.3	7.1	9.8	19.7	17.4	82.7	39.3	34.3	45.5
Yadkin	M	22,133	66.1	7.1	14.7	9.9	6.2	60.5	65.5	--	5.0

TABLE NO. II-1 (Continued)

POPULATION CHARACTERISTICS

Counties are arranged in order of maximum decrease to maximum increase for 1940 - 1950 decade. Minus sign (-) denotes decrease. (C), (P), and (M) denotes Coastal Plain, Piedmont Plateau, and Mountain Region, respectively.

COUNTY AND REGION		1950	PER SQ. MILE	INCREASE BY PERCENTAGE					PER CENT OF 1950		
				1940 1950	1930 1940	1920 1930	1910 1920	1890 1910	FARM	URBAN	NON- WHITE
Graham	M	6,886	23.8	7.3	9.9	19.9	2.6	107.8	52.9	--	3.2
Cabarrus	P	63,783	177.2	7.4	34.0	31.4	28.5	251.5	14.0	66.0	15.3
Union	P	42,034	65.4	7.5	-4.6	13.7	8.3	98.7	55.9	24.1	22.6
Harnett	C	47,605	78.6	7.6	16.7	33.9	27.7	247.4	49.5	20.3	26.3
Richmond	P	39,597	83.0	7.6	8.2	33.0	30.0	65.4	21.7	34.3	30.5
Nash	C	59,919	108.5	7.8	5.4	28.5	21.7	189.3	51.3	24.7	42.4
Haywood	M	37,631	69.3	8.1	23.1	20.3	11.8	181.5	33.0	27.1	2.2
Alexander	P	14,554	57.1	8.2	4.1	5.8	5.3	54.3	63.9	--	7.1
Granville	P	31,793	58.6	8.3	2.2	7.0	6.9	29.8	52.6	21.0	46.7
Chowan	C	12,540	69.7	8.4	2.6	5.9	-5.8	36.8	48.8	35.6	43.6
Wilson	C	54,506	146.1	8.5	11.8	22.0	30.2	192.3	41.5	42.2	40.4
Rowan	P	75,410	145.9	9.0	22.1	28.6	17.4	212.6	18.9	41.1	17.1
Surry	M	45,593	84.9	9.1	5.1	22.4	9.3	136.3	41.4	28.4	5.7
Bladen	C	29,703	33.8	9.4	21.3	13.3	9.7	77.3	59.4	--	41.2
Wayne	C	64,267	115.8	10.2	10.0	21.5	22.2	146.2	37.8	39.2	42.2
Cleveland	P	64,357	138.1	10.9	11.8	51.5	16.2	215.5	40.1	35.3	21.9
Columbus	C	50,621	53.9	10.9	21.1	25.2	7.5	183.4	59.3	8.4	33.9
Hertford	C	21,453	60.3	10.9	10.3	7.7	5.6	54.9	47.5	16.7	60.0
Lenoir	C	45,953	117.5	11.5	15.4	20.8	29.8	208.8	40.1	39.9	43.1
Iredell	P	56,303	95.3	11.7	8.0	23.0	10.6	121.2	40.1	42.7	17.8
McDowell	M	25,720	58.2	11.8	13.1	21.3	23.8	135.0	29.8	21.9	5.6
Rockingham	P	64,816	113.3	11.9	13.3	15.7	21.1	155.5	31.9	38.5	20.1
Brunswick	C	19,238	22.0	12.3	8.3	6.3	3.1	76.5	51.9	--	36.6
Stanly	P	37,130	93.1	13.1	8.7	10.2	37.8	205.6	29.3	31.8	11.4
Scotland	C	26,336	83.1	13.4	15.2	29.3	1.5	--	37.1	27.1	47.8
Lincoln	P	27,459	89.2	13.5	5.7	28.0	4.3	118.2	43.6	19.7	12.7
Randolph	P	50,804	63.4	14.0	22.9	17.5	4.6	101.7	31.1	15.2	8.5
Robeson	C	87,769	93.0	14.2	15.6	21.7	5.3	178.6	54.4	10.5	57.3
Buncombe	M	124,403	192.6	14.4	11.0	52.7	28.8	252.5	15.8	47.0	12.3
Forsyth	P	146,135	344.7	15.5	13.2	44.5	63.3	414.0	9.3	65.8	28.4
Davidson	P	62,244	113.6	16.6	11.5	36.0	19.7	186.8	21.9	39.7	10.3
Burke	M	45,518	90.0	17.9	31.3	26.2	8.8	204.6	20.2	24.3	7.5
Pasquotank	C	24,347	106.3	18.4	7.4	8.3	5.9	126.5	13.6	52.1	38.2
Henderson	M	30,921	80.9	18.7	11.3	28.3	12.2	145.5	35.4	19.7	6.7
Catawba	P	61,794	152.2	19.6	17.4	30.0	21.2	230.5	23.7	33.7	9.1
Caldwell	M	43,352	91.1	21.1	27.8	40.2	-2.9	252.3	27.6	18.2	6.9
Alamance	P	71,220	164.1	24.0	36.3	28.8	14.0	289.5	18.1	41.5	18.5
Guilford	P	191,057	293.5	24.1	15.7	67.8	31.0	582.0	10.8	66.0	19.5
Transylvania	M	15,194	40.1	24.1	27.7	3.1	29.4	158.2	31.3	25.7	4.9
Wake	P	136,450	157.6	24.6	15.6	26.1	18.9	177.3	21.8	53.1	29.3
Lee	P	23,522	92.2	25.5	10.3	26.8	17.8	0.0	35.1	42.6	26.0
Carteret	C	23,059	43.3	26.1	8.2	9.9	11.7	113.1	11.5	36.2	12.6
Gaston	P	110,836	309.6	26.6	12.1	52.4	38.3	524.0	9.5	55.2	13.4
Durham	P	101,639	339.9	26.7	19.4	59.2	19.7	462.9	7.6	72.2	33.3
Mecklenburg	P	197,052	363.6	29.8	18.6	58.6	20.4	362.0	7.4	71.5	25.4
New Hanover	C	63,272	326.1	32.0	11.5	5.9	26.8	163.1	2.7	71.2	31.4
Orange	P	34,435	86.5	49.3	9.0	18.3	18.8	130.8	28.5	26.7	25.1
Craven	C	48,823	67.3	56.0	2.1	5.6	13.5	137.8	21.2	32.4	32.4
Cumberland	C	96,006	145.2	61.8	31.2	29.0	-0.6	250.7	15.8	39.7	28.0
Onslow	C	42,047	55.6	134.4	17.3	4.0	4.1	308.0	25.6	18.2	15.9

and emigration out of North Carolina. The table below and Graph No. II-2 show this interchange for the past four decades and the resultant net loss of population to other states. During all four periods North Carolina's greatest total and net loss was to the neighboring State of Virginia. Similarly the largest single contributing state was South Carolina. The 47 per cent increase in emigration during the 1940-50 decade reflects the somewhat abnormal conditions during World War II when northern labor shortage was an important incentive to migration. Nevertheless this unbalanced out-of-state flow has persisted for many years to the detriment of North Carolina's economy, and although increased southern industrialization may retard the upward trend in net loss it is probable that some time will elapse before this imbalance is reversed. Nor is this merely a loss of unskilled labor and non-whites seeking better employment opportunities even though these classes are predominant in the movement. The 1940 census (1950 data are not available) shows 249,579 North Carolina-born non-whites living in other states and a counter movement of 101,758. This represents a net loss of 147,821 non-whites or 55.3 per cent of the combined white and non-white net loss.

INTERSTATE MIGRATION OF U. S. NATIVE-BORN POPULATIONS

	<u>1950</u>	<u>1940</u>	<u>1930</u>	<u>1920</u>
Born in N. C. - living in other states	900,435	611,096	554,912	443,844
Born in other states - living in N. C.	507,470	343,594	315,278	157,996
Net loss to all other states	392,965	267,502	239,634	285,848
Net loss to Virginia alone	122,510	72,666	65,222	75,918
Net gain from South Carolina alone	74,045	79,731	87,730	*

* Data not available

The table below attempts to accentuate a selected group of predominant characteristics with reference to Eastern North Carolina populations. Entered opposite each of the nine selected characteristics are those three Coastal Plain counties which are most outstanding with respect thereto. To further emphasize the regional aspect a number in parenthesis is added after the county name to indicate its relative rank among all of the 100 counties of the State.

POPULATION CHARACTERISTICS OF COASTAL COUNTIES AND RELATIVE RANK WITH RESPECT TO STATE

Smallest total population	Tyrrell (1)	Camden (2)	Dare (3)
Rate of decrease; 1940-50	Hyde (2)	Dare (3)	Tyrrell (4)
Rate of increase; 1940-50	Onslow (1)	Cumberland (2)	Craven (3)
Least density per sq. mile	Hyde (1)	Tyrrell (2)	Dare (3)
Percentage of farm residents	Greene (1)	Jones (10)	Sampson (11)
Highest median age	Dare (1)	Currituck (2)	New Hanover (5)
Percentage non-white	Northampton (2)	Hoke (3)	Hertford (4)
Lowest median family income	Gates (2)	Hyde (4)	Hoke (6)
Highest per cent below \$2000	Hyde (3)	Gates (4)	Tyrrell (7)

Of the nine listed criteria only one - "Rate of Increase; 1940-50" - can be classed as economically favorable, and as noted above, the preeminent positions

TABLE NO. II-2

REGIONAL POPULATION TOTALS AND TRENDS - 1890 TO 1950

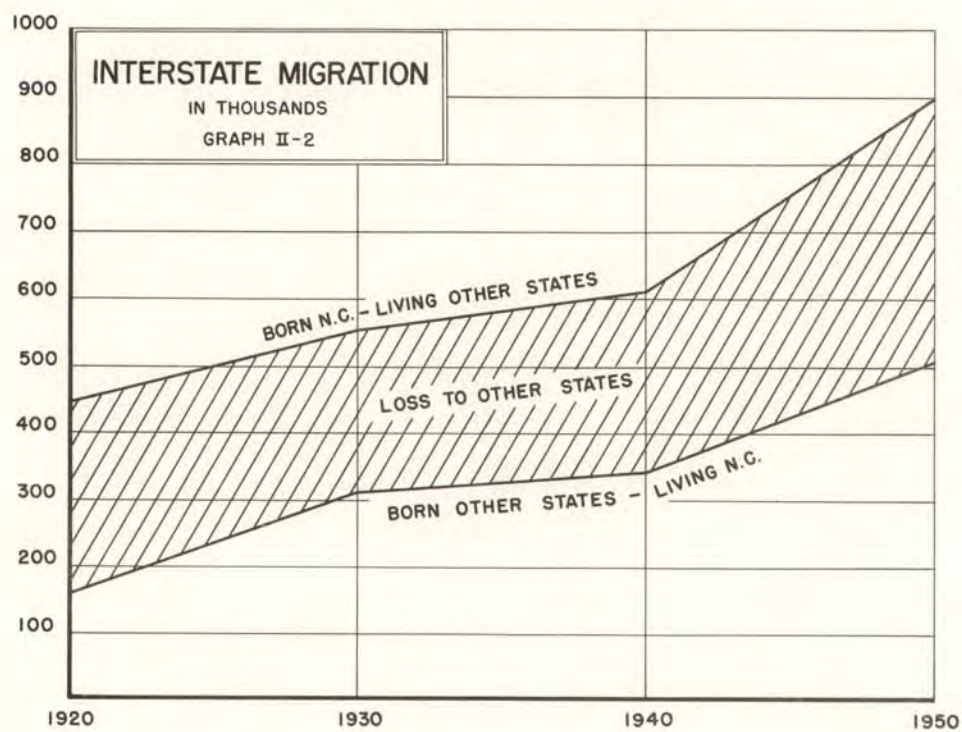
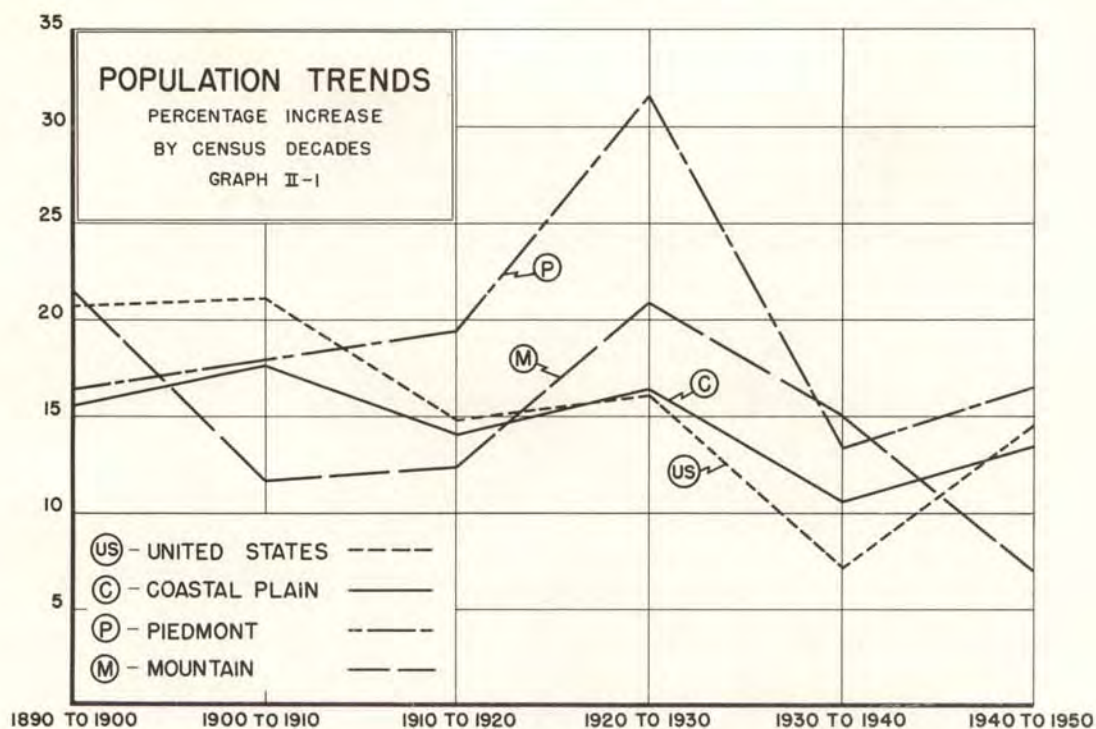
YEAR	COASTAL		PIEDMONT		MOUNTAIN		STATE TOTAL		U. S.
	POP.	% In-crease	POP.	% In-crease	POP.	% In-crease	POP.	% In-crease	% In-crease
1950	1,401,860	13.4	1,976,138	16.5	683,931	6.9	4,061,929	13.7	14.5
1940	1,236,435	10.6	1,695,596	13.3	639,592	15.0	3,571,623	12.6	7.2
1930	1,118,064	16.3	1,496,546	31.5	555,666	20.8	3,170,276	23.9	16.1
1920	961,228	14.0	1,137,962	19.4	459,933	12.3	2,559,123	16.0	14.9
1910	843,553	17.6	953,288	17.8	409,446	11.6	2,206,287	16.5	21.0
1900	717,349	15.6	809,513	16.4	366,948	21.4	1,893,810	17.0	20.7
1890	620,239	--	695,491	--	302,217	--	1,617,947	15.6	25.5

TABLE NO. II-3

INCORPORATED COASTAL PLAIN TOWNS OF OVER 2500 POPULATION

TOWN	COUNTY	1950	1940	TOWN	COUNTY	1950	1940
Wilmington	New Hanover	45,043	33,407	Smithfield	Johnston	5,574	3,678
Fayetteville	Cumberland	34,715	17,428	Morehead City	Carteret	5,144	3,695
Rocky Mount	Nash-Edge.	27,697	25,568	Williamston	Martin	4,975	3,966
Wilson	Wilson	23,010	19,234	Plymouth	Washington	4,486	2,461
Goldsboro	Wayne	21,454	17,274	Edenton	Chowan	4,468	3,835
Kinston	Lenoir	18,336	15,388	Clinton	Sampson	4,414	3,557
Greenville	Pitt	16,724	12,674	Whiteville	Columbus	4,238	3,011
New Bern	Craven	15,812	11,815	Jacksonville	Onslow	3,960	873
Elizabeth City	Pasquotank	12,685	11,564	Mount Olive	Wayne	3,732	2,929
Washington	Beaufort	9,698	8,569	Ahoskie	Hertford	3,579	2,313
Lumberton	Robeson	9,186	5,803	Beaufort	Carteret	3,212	3,272
Roanoke Rapids	Halifax	8,156	8,545	Farmville	Pitt	2,942	2,980
Tarboro	Edgecombe	8,120	7,148	Scotland Neck	Halifax	2,730	2,559
Laurinburg	Scotland	7,134	5,685	Selma	Johnston	2,639	2,007
Dunn	Harnett	6,316	5,256	Belhaven	Beaufort	2,528	2,360

In addition to the 30 incorporated towns listed above there were four unincorporated Coastal Plain towns having 1950 populations in excess of 2500 as follows: Belmont - South Rosemary in Halifax County (Pop. 3173); Erwin in Harnett County (Pop. 3344); Midway Park in Onslow County (Pop. 3703); and South Fayetteville in Cumberland County (Pop. 3428).



with respect to recent population growth rates enjoyed by the counties of Onslow, Cumberland and Craven can be accounted for almost entirely by the influx of service and attendant personnel to and near the three major military establishments in those counties. Also, it will be noted that for the selected characteristics the lowest state-wide relative rank is that of No. 11 listed for Sampson County with respect to "Percentage of farm residents." Generally speaking it would appear that economic or other factors are operative in the northeastern section of the State which are conducive to retarded growth rates.

III. REGIONAL ECONOMY

Numerous factors have tended to promote the present rather marked differentiation between the economic complexion of the Coastal Plain as compared with that of the Piedmont and Mountain areas. Aside from the obvious one of earlier settlement, some of these factors are:- social and racial origins of the inhabitants; physiographic characteristics including relative extent and configuration of land and water areas, soil types, fertility and original forest cover; early accessibility as influenced by relative ease of providing communication and transportation facilities; early availability of water power; external pressures related to world markets with their changing conditions of supply and demand for particular commodities; and the abrupt conversion from a slave-holding economy during the last century.

COLONIAL BEGINNINGS:- Over 60 years passed between the first visits of European explorers along the eastern coast of North Carolina to the ill-fated 1585 and subsequent attempts by Sir Walter Raleigh to establish permanent settlements on Roanoke Island. After the Jamestown Colony in Virginia became well established migrations from there started in the early 1620's and for many years furnished the principal source of immigration for the new settlements around Albemarle Sound. In 1663 extensive grants were made by King Charles II to a group of proprietors who administered the colony through their appointed governors.

Growth was slow during the following 60 year period and was marked by disputes with the governors and over boundaries; by pirate (e.g., "Blackbeard") raids along the coast; Indian outbreaks and harassment by Virginia, such as restrictions upon the sale and shipment of North Carolina tobacco through her ports. Better progress was made under the Royal Governors (1729-1775), the population increasing from 30,000 to 265,000 during that period.

Bath, the oldest town, was incorporated in 1705, followed by Edenton (the first seat of Government) and New Bern in 1710. Brunswick, near the mouth of Cape Fear River, was founded in 1725 and Wilmington in 1730. The early settlers were largely of English stock, most of them coming from the adjacent Colonies of Virginia and South Carolina. Beginning about 1739 a steady stream of Scotch-Irish and Germans poured in, mostly from Pennsylvania. Scotch Highlanders arrived directly from Europe, settling in the Cape Fear Valley. Outside of a few Swiss and French, negroes made up the remaining population, reaching a total of about 30,000 by 1765. By the time of the Revolution expansion of the colored population was largely due to natural increase since relatively few slaves were imported after the mid-eighteenth century.

Cattle raising and grazing was one of the earliest pursuits, the herds being driven overland to Virginia markets. A little later tobacco and corn were the chief crops. Cotton was unimportant until the 19th century. Production of naval stores (tar, pitch and turpentine) was the chief industry. Large land grants in the Cape Fear, Neuse and Albemarle regions furthered the growth of the plantation system in these areas and consequent use of slave labor. However the Tidewater region was still predominately one of relatively small farms.

NINETEENTH CENTURY TRENDS:- North Carolina dropped in population from third place in 1790 to seventh by 1840. More than one half of the inhabitants lived west of Raleigh yet the government was dominated politically by the landed aristocracy of the east who repeatedly defeated efforts of the west to launch internal improvement programs or obtain an equitable reapportionment of representation until a new constitution was finally adopted in 1835.

Soil exhaustion, lack of communications and educational facilities, plus the lure of the west caused many thousands to leave the State. In 1860 only two towns, Wilmington (pop. 13,446) and New Bern (pop. 5,432) had populations in excess of 5,000. With the construction of railroads and other transportation facilities, beginning in the 1840's, farming conditions improved and industry expanded rapidly in the Piedmont Plateau. With this western industrial expansion and parallel growth in population the early preeminence of the Coastal Plain disappeared and the disparity has consistently increased up to the present time.

Among the many factors contributing to this westward shift, the retarded development of transportation facilities in the eastern areas was important. Marshland barriers made for expensive railroad construction and in the Tidewater area the deeply indented coastline tended to discourage such construction of north-south routes which would give direct access to the profitable mid-Atlantic markets. Even the east-west routes encountered many obstacles: although efforts to provide a single-system route across the entire State have been continuous since 1845, it has not been until the present time (1954) that there is promise of such a connection as a result of recent negotiations between the Southern and the Atlantic & Eastern Carolina Railroads. Consequently the coastal waterways assumed an important role in transportation from the earliest times to within recent years.

North Carolina suffered severely during the Civil War and the reconstruction period that followed. It furnished more soldiers to the Confederate armies than any other state even though much anti-slavery sentiment existed, particularly in the western regions. Slaveholding was generally concentrated in cotton and tobacco raising counties of the inner zone of the Coastal Plain with very few slaves held in the areas along the coast, the central and southern Piedmont or the highlands. The 1850 census lists 28,303 slaveholders out of a total population of 553,028, with a large majority holding less than ten slaves.

The chaotic conditions following the Civil War brought radical changes. The larger holdings were converted to tenant farming. During the Reconstruction Period cash disappeared from circulation - at one time there were only five banks open with a combined capitalization of \$395,000 in the entire State. With more diversified farming and developing industry the Piedmont region continued to forge ahead.

RECENT TRENDS:- Care should be exercised in applying generalities when dealing with the economic trends of Eastern North Carolina unless some distinction is made between pre-World War II conditions and those of the past few years. However, the continued effect of certain factors are rather apparent. One of the most important is the influence of the greatly expanded program of highway con-

struction since the 1920's. Emphasis on secondary and farm-to-market roads has encouraged diversification in farming and a somewhat improved social and economic structure. On the other hand, improved farming methods and mechanization has released many people who, too often, have moved elsewhere in their search for a means of livelihood. Other occupations, such as fishing and lumbering, or the introduction of new industries, failed to compensate for this reduced farm labor demand. Perhaps, as some authorities claim, the innate characteristics of the population and its parent stock - their individualism and spirit of independence - have been factors not conducive to collective effort or radical departure from long established procedures. One-crop practices and tenant farming still operate to retard attainment of higher living standards.

Expanded means of land transportation throughout the State have tended to reduce the early advantage of coastal communities having access to shallow-draft waterways. Also, the speed and flexibility of truck transportation further reduced this margin. Many waterways, natural or improved in the late nineteenth and early twentieth centuries, have all but ceased to carry traffic.

With some risk of over-generalization the following observations may be in order: a few areas along the Outer Banks and sounds depend largely upon fisheries as a source of livelihood, supplemented in some cases by income from small farms and the tourist trade. The percentage of colored population is relatively small in these areas, now only seven per cent in Dare County. In every other Coastal Plain county except Carteret and New Hanover, agriculture is the leading occupation and in most instances exceeds the total of all other employment. Median family income for these 41 counties varies from a low of \$857 for Gates County to a high of \$1951 for Cumberland. These may be compared to a state-wide median of \$1864 and a maximum of \$2690 for Mecklenburg County.

Table No. III-1 lists some of the more important economic characteristics of the 41 Coastal Plain county populations. It will be noted that these have been grouped into two main subdivisions of 25 and 16 counties respectively. In the first group are included those counties which border on the ocean, the sounds, or other improved waterways. (This group of 25 coincides with the constitutionally prescribed county membership of the North Carolina Coastal Marine Council, the organization which initially sponsored the present survey). The remaining 16 counties are within the inner or western zone of the Coastal Plain.

Again it should be noted that the data listed are subject to the numerous qualifications and interpretations as applied by the Bureau of the Census. For instance the number of unemployed listed probably falls considerably short of the potentially available man-power for new industries or other pursuits, since many part-time workers would be carried as employed if that were their defined, though not necessarily actual, status during the "Census Week." This observation is particularly applicable to part-time agricultural workers.

According to recent surveys the current expansion of industry in the south has yet to absorb a major portion of the available labor supply. This is particularly true of the lesser urbanized areas of Eastern North Carolina where farming

trends have released many full or part-time workers. Contrary to once widely accepted opinion most of this labor potential can be developed, through minimum training programs, into efficient workers. The following is a quotation from a recent survey by the National Planning Association: "In the judgement of nearly all of the companies covered in this study, labor productivity in the South is equal or even superior to that in the North." Similar conclusions have been reached by other authorities, both professional and industrial. An informative discussion of this matter appears in the March-April, 1954 issue of the HARVARD BUSINESS REVIEW - "Fact and Fiction about Southern Labor," by Stefan H. Robock and John M. Peterson.

With respect to wages, it is difficult to generalize; however, hourly earnings in most industries average 10 to 30 per cent lower in the south than in the rest of the nation. On the other hand, within the south, as in the north, wide wage differentials exist between rural and urban area. Even wider than average differentials exist between low-skilled labor, which is plentiful, and trained workers. In a few selected southern cities wage rates may be actually higher than in certain lower scale northern communities. Similarly, conditions are variable with respect to southern unionization. Although unionization is developing rapidly in some of the larger metropolitan districts, particularly in the building trades, the chemical, paper and pulp and other new industries, it has made little headway in the rural and eastern coastal areas or in the textile, shoe and apparel industries.

The percentage of farm population varies from a minimum of 1.4 and 2.7 for Dare and New Hanover counties, respectively, to 82.6 for Greene, the highest in the State, which has a total of 33.6 per cent classed as "rural-farm." Comparable percentages for the State as a whole in 1930 and 1940 were 50.4 and 46.4, respectively. Between 1940 and 1950 the State's farm population decreased by some 280,000 while the total population increased by nearly a half-million people.

Although perhaps over-emphasized by some sociologists the high prevalence of farm tenancy, together with crop-lien and time-credit practices have been significant deterrents to economic and social progress in the south. Industrialization, diversified farming and marketing trends in recent years are tending toward better conditions; however, farm tenancy in some eastern areas continues at a high level and undoubtedly operates as an adverse factor in its economy and sociological progress. Originally brought about by post-Civil War conditions when freed slaves became tenants, along with many poverty-stricken whites, the system has been nurtured by one-crop farming, particularly adaptable to cotton and tobacco; by lack of cash operating capital and inability to accumulate wealth under crop-lien conditions; by land speculation and large inherited holdings; and by lack of private or public programs for the encouragement of home and farm ownership. The frequent shifts of tenants from farm to farm is not conducive to a stable rural economy. Also, there is a certain degree of relationship between the percentage of farms operated by tenants and illiteracy as measured by the median number of school years completed by the agricultural population of age 25 or over. These data are listed below for the 10 counties having the highest tenant-operated farm percentages in the entire State.

PERCENTAGE OF FARMS OPERATED BY TENANTS AND MEDIAN
SCHOOL YEARS COMPLETED BY RURAL-FARM POPULATION

COUNTY	TENANCY	MEDIAN SCHOOL YEARS COMPLETED	
		Total Rural-Farm	Non-White Rural-Farm
Edgecombe	77.6	5.0	4.0
Greene	77.3	6.6	4.9
Wilson	75.9	6.1	4.4
Pitt	73.0	6.3	4.4
Nash	69.8	5.8	4.3
Scotland	69.6	5.5	4.4
Lenoir	68.7	6.6	4.9
Hertford	68.6	6.3	5.7
Robeson	68.2	6.4	5.7
Martin	67.6	5.9	4.6

The above figures might be compared with those applicable to the State as a whole of 38.3 per cent tenancy and median school years completed, rural-farm total - 7.0; rural-farm non-white - 5.3. It will be noted that all of the above 10 counties are in the tobacco and cotton belt of the Coastal Plain. Comparisons based on selected districts and groups, rather than the State as a whole, would be even more revealing. For instance, the urban white population (age 25 and older) for the entire State shows a median of 10.4 school years completed.

The percentage of workers engaged in manufacturing varies widely in the Coastal Plain counties and is, of course, much lower than in the industrialized Piedmont section where eight counties show percentages of 50 or more. Greene County has the smallest percentage - 1.6; followed closely by Dare with 4.3 and Hyde with 5.9. The highest percentage in the Coastal Plain is found in Washington County with 34.5, followed by Scotland with 31.5 and Tyrrell with 24.8. The first listed group of 25 counties in Table No. III-1 which are served by the inland waterways, have a total manufacturing employment percentage of 14.5 as compared to 13.5 per cent for the remaining 16 counties.

LABOR RESOURCES:- The Employment Security Commission of North Carolina issues a bi-monthly report on the availability of recruitable labor, by counties, based upon local surveys. Table No. III-2 gives selected data from the January 15, 1954 release. It should be noted that the listed totals do not represent unemployed persons but rather the composite of several classes and usually involve consideration of the labor supply in adjacent counties and areas which might be attracted by new industries offering working conditions and wages equal to, or slightly better than, the present industrial pattern of the reporting county. Also, prospective workers would come from such groups as: (1) housewives that would join the labor force should industry offer an opportunity providing wage scales or conditions of employment more favorable than those now prevailing in the area; (2) workers now commuting to other areas, but who would probably choose advantageous local employment; (3) youths that are expected to join the labor force of the area; (4) handicapped workers and older employables not cur-

rently being absorbed by present industries; (5) minority groups that would readily accept regular employment; (6) new entrants from agriculture seeking industrial employment for the first time.

BUYING POWER:- Median family income as reported by the Bureau of the Census, though useful for comparative purposes, does not necessarily reflect actual income, nor effective buying power, due to various factors related to reporting methods, as explained by the Bureau. For instance, this median income figure, on either side of which would be found one half of all earners with incomes up to, but not over, \$10,000, could be at considerable variance with average income. **SALES MANAGEMENT**, an authoritative publication on national marketing has developed and published various specialized data which more accurately represent buying potentials. The following Table No. III-3 contains advanced data from the May 10, 1954, issue of that magazine including, by Coastal Plain counties: estimated January 1, 1954 populations and number of families; gross cash farm income; total, family, and per capita effective buying income; and retail sales per family. The corresponding data for the entire State has been added for comparative purposes.

INCOME TRENDS:- Based upon the most recent statistics issued by the U. S. Department of Commerce (Survey of Current Business) for 1952, North Carolina ranked fourth from last among the 48 states with respect to per capita income from all sources (wages, proprietary, property and others). The per capita income was listed as \$1049 compared to a national average of \$1639. Only Alabama, Arkansas and Mississippi had lower rates. The total income for the State was \$4,383,000,000, or an increase of \$503,000,000 over the 1950 total. However, in contrast to the relatively low rank in per capita income the State showed an increase in total income of 288 per cent as compared to the national average of 237 per cent during the 13 year period, 1940 to 1952. Further, for the longer interval of 1929-1952 North Carolina had an increase in per capita income of 239 per cent as compared to a national average of 141 per cent, and in this respect led all other states except South Carolina, Georgia and New Mexico.

Unfortunately no comparable up-to-date statistics are available which break down the above data to county levels. In fact such estimates of per capita income are not made by the Bureau of the Census but must be derived by analytical methods based upon related data published by the Bureau and other agencies. Such a derivation was completed in 1952 after a two year research program by a University of North Carolina group in cooperation with an association of seven southeastern State universities and certain Federal agencies, including the Tennessee Valley Authority. This association, organized in June, 1949, is known as the Conference on the Measurement of County Income. The local study pertaining to North Carolina counties was under the direction of Dr. Lowell D. Ashby, Associate Professor of Economics at Chapel Hill and the results were published in August, 1952 by the School of Business Administration, University of North Carolina. The most recent year for which results were derived and published was 1947. Table No. III-4 presents various 1947 data from the above publication, and although per capita income for the entire State increased from \$860 in 1947 to \$1049 in 1952 it is probable that, when measured in percentages of total income,

TABLE NO. III—1

ECONOMIC CHARACTERISTICS OF COASTAL PLAIN COUNTY POPULATIONS

Counties	Population over Age 14 Years				Civilian Labor Force				Total Employment by Industry Groups												Median Family Income	
	Total		Non-White		Total		Non-White		Agriculture		Forestry and Fish.		Construction		Manufacturing		Others		Unemployed			
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Total	Non-White
Beaufort.....	12,343	13,055	4,412	4,649	9,693	3,125	3,308	1,574	4,240	547	136	5	683	9	1,397	143	2,933	2,202	304	219	\$ 1,269	\$ 772
Bertie.....	8,429	8,621	4,632	4,756	7,245	2,202	4,037	1,433	4,667	1,178	24	10	262	1	1,021	56	1,191	904	80	53	1,283	855
Bladen.....	9,417	9,284	3,635	3,601	7,767	2,275	2,928	1,061	4,157	897	24	2	437	3	1,669	347	1,330	962	150	64	1,423	1,041
Brunswick.....	6,424	6,226	2,139	2,184	4,935	1,060	1,580	422	2,328	401	289	3	381	-----	904	55	917	571	116	30	1,343	829
Camden.....	1,818	1,748	670	614	1,414	267	552	101	685	19	3	-----	127	-----	296	22	274	213	29	13	1,316	-----
Carteret.....	8,127	8,122	1,001	943	5,834	1,727	695	343	802	85	1,102	11	656	2	537	254	2,477	1,282	260	93	1,979	1,063
Chowan.....	4,184	4,297	1,608	1,814	3,193	1,060	1,301	552	1,268	39	87	15	266	6	550	197	950	712	72	91	1,315	836
Craven.....	19,340	15,455	5,115	5,430	10,362	3,539	3,732	1,617	2,991	440	54	5	798	16	1,503	111	4,816	2,830	200	137	1,453	872
Cumberland.....	40,014	29,233	9,428	8,812	17,234	7,753	5,606	2,942	3,416	435	15	1	1,908	39	2,920	1,015	8,409	5,923	566	340	1,769	1,183
Currituck.....	2,343	2,160	726	644	1,713	329	566	119	742	28	67	-----	165	3	243	10	461	270	35	18	1,424	-----
Dare.....	1,985	1,983	146	142	1,260	317	107	53	28	3	363	1	238	1	58	6	520	285	53	21	1,514	-----
Gates.....	3,326	3,200	1,572	1,540	2,599	331	1,274	156	1,483	74	5	-----	105	1	546	7	437	245	23	4	857	622
Hertford.....	7,195	7,187	4,050	4,064	5,813	1,467	3,337	894	2,819	277	26	2	365	9	1,141	73	1,349	1,059	113	47	1,328	1,013
Hyde.....	2,256	2,281	808	862	1,704	453	634	242	866	29	105	6	178	-----	115	6	389	348	51	64	914	692
Jones.....	3,528	3,483	1,504	1,516	2,775	449	1,160	259	1,983	157	7	1	88	-----	252	6	413	275	32	10	1,295	818
Martin.....	8,769	8,875	3,975	4,156	7,167	1,946	3,200	1,107	4,105	588	33	2	385	8	907	112	1,609	1,128	128	108	1,321	940
New Hanover.....	21,164	24,421	6,168	7,579	16,616	8,646	4,765	3,530	629	361	123	1	1,732	43	2,962	1,250	10,172	6,514	998	477	1,951	1,072
Onslow.....	20,194	10,614	2,299	1,985	6,747	2,051	1,514	697	2,685	191	185	3	463	5	557	27	2,612	1,683	245	142	1,312	1,123
Pamlico.....	3,350	3,362	1,014	1,087	2,545	571	765	312	969	106	281	1	167	3	282	28	719	355	127	78	1,256	878
Pasquotank.....	8,530	8,924	2,959	3,396	6,279	2,410	2,266	1,032	1,133	46	21	1	538	9	1,422	334	2,892	1,873	273	147	1,617	938
Pender.....	6,026	6,003	2,695	2,771	4,747	1,375	2,075	863	2,656	592	42	-----	302	6	771	45	881	623	95	109	1,081	740
Perquimans.....	3,266	3,318	1,444	1,496	2,540	549	1,081	225	1,192	30	12	-----	100	1	537	58	670	420	29	40	1,163	836
Pitt.....	20,522	22,109	8,537	9,741	16,071	7,017	6,842	4,147	8,361	2,031	11	1	1,099	20	1,339	213	4,601	3,568	660	1,184	1,343	861
Tyrrell.....	1,728	1,683	651	618	1,362	296	495	127	560	21	23	-----	111	1	392	12	256	256	20	6	1,040	-----
Washington.....	4,427	4,328	1,810	1,762	3,505	752	1,345	379	1,057	37	67	15	178	5	1,350	78	770	584	83	33	1,691	1,167
Sub-Total.....	228,705	201,097	72,998	76,162	151,120	51,967	55,165	24,187	55,822	8,612	3,105	86	11,732	191	23,671	4,465	52,048	35,085	4,742	3,528	-----	-----
Columbus.....	16,147	16,278	5,063	5,260	13,115	4,360	4,002	1,591	8,057	2,347	24	-----	640	5	1,363	87	2,831	1,806	200	115	\$ 1,376	\$ 933
Duplin.....	13,539	13,436	4,711	4,788	11,066	3,026	3,820	1,477	7,626	1,458	9	-----	481	5	869	118	1,959	1,358	122	87	1,064	768
Edgecombe.....	16,406	17,943	7,764	8,784	13,427	5,770	6,309	3,172	5,871	1,137	7	-----	886	18	1,673	776	4,571	3,385	419	454	1,752	978
Greene.....	5,713	5,696	2,428	2,475	4,622	930	1,926	498	3,833	467	5	-----	134	1	79	11	540	422	31	29	1,325	709
Halifax.....	18,366	19,486	9,455	9,957	15,094	5,730	7,827	2,575	6,364	1,174	13	-----	792	17	3,769	1,466	3,716	2,824	440	249	1,568	807
Harnett.....	15,936	16,004	3,862	3,932	12,649	3,492	3,040	1,037	6,161	455	6	-----	864	13	2,413	801	2,977	2,102	228	121	1,755	958
Hoke.....	4,923	5,151	2,721	2,951	3,912	1,312	2,226	757	2,317	367	4	-----	257	1	436	187	805	687	93	70	991	579
Johnston.....	21,397	21,903	4,197	4,544	17,563	4,738	3,360	1,214	10,698	1,584	8	16	1,151	10	1,823	758	3,634	2,260	249	110	1,419	811
Lenoir.....	14,821	16,451	6,080	6,759	11,767	4,953	4,792	2,417	5,112	558	6	1	959	21	1,235	776	4,002	3,054	453	543	1,499	941
Nash.....	19,375	20,243	7,497	7,904	16,173	5,284	6,403	2,231	8,363	1,405	7	2	948	19	1,671	600	4,748	2,890	436	368	1,722	934
Northampton.....	9,146	9,404	5,460	5,570	7,378	1,597	4,462	971	4,491	442	4	-----	359	3	1,106	137	1,279	948	139	67	1,155	778
Robeson.....	26,467	28,219	14,020	15,043	21,839	9,717	11,668	5,847	12,238	4,333	8	-----	1,408	21	2,401	874	5,175	4,138	609	351	1,347	892
Sampson.....	16,265	16,448	5,513	5,859	13,275	3,121	4,616	1,385	8,494	936	7	-----	754	9	1,567	350	2,321	1,747	132	79	1,067	776
Scotland.....	8,082	8,700	3,618	3,878	6,382	2,824	2,770	1,091	2,296	276	6	-----	391	6	1,787	989	1,644	1,404	258	149	1,411	786
Wayne.....	21,319	22,899	8,770	9,692	15,964	5,306	5,759	2,455	6,433	632	3	-----	1,215	26	2,380	396	5,411	3,884	522	368	1,388	865
Wilson.....	17,940	18,865	6,684	7,184	14,493	5,709	5,214	2,646	6,319	1,252	3	-----	1,170	14	1,545	397	4,791	3,390	665	656	1,692	973
Sub-Total.....	245,842	257,126	97,843	104,580	198,719	67,869	78,194	31,364	104,673	18,823	120	19	12,409	189	26,117	8,723	50,404	36,299	4,996	3,816	-----	-----
Coastal Plain.....	474,547	458,223	170,841	180,742	349,839	119,836	133,359	55,551	160,495	27,435	3,225	105	24,141	380	49,788	13,188	102,452	71,384	9,738	7,344	-----	-----
State.....	1,390,072	1,435,312	336,377	361,231	1,073,641	439,283	261,275	125,653	320,959	39,138	3,745	156	84,693	1,695	277,408	131,544	358,446	245,568	28,390	21,182	\$ 1,864	\$ 1,056

TABLE NO. III-2

SUMMARY OF ESTIMATED RECRUITABLE LABOR BY COASTAL PLAIN COUNTIES
 (As reported Jan. 15, 1954 by the North Carolina Employment Security Commission)

COUNTY	RECRUIT- ABLE LABOR TOTAL	WHITE MALES	WHITE FEMALES	NON-WHITE MALES	SKILLED AND SEMI- SKILLED	TRAINABLE FOR SKILLED JOBS
STATE	211, 825	72, 240	76, 430	32, 710	32, 710	82, 095
Beaufort	1, 310	325	390	335	310	480
Bertie	1, 500	380	300	445	300	950
Bladen	1, 615	475	725	200	790	425
Brunswick	2, 205	685	455	565	430	1, 300
Camden	220	95	55	25	110	70
Carteret	1, 900	300	875	500	630	925
Chowan	1, 560	450	400	510	685	425
Columbus	1, 975	775	575	375	750	600
Craven	900	330	85	360	225	135
Cumberland	4, 000	1, 300	1, 500	500	2, 200	1, 600
Currituck	300	95	130	25	100	85
Darè	210	60	115	15	50	90
Duplin	2, 000	600	500	600	500	1, 000
Edgecombe	2, 300	600	735	405	900	645
Gates	465	160	75	195	185	135
Greene	420	150	70	100	120	215
Halifax	2, 050	410	560	670	890	950
Harnett	3, 000	700	1, 200	600	1, 550	1, 200
Hertford	2, 210	500	850	360	790	1, 180
Hoke	1, 500	200	300	300	575	700
Hyde	600	145	85	185	130	230
Johnston	2, 455	875	960	320	455	965
Jones	300	125	50	75	85	40
Lenoir	1, 930	400	200	330	380	1, 050
Martin	2, 240	550	525	615	590	1, 275
Nash	2, 240	515	795	380	900	665
New Hanover	3, 125	1, 005	960	660	825	1, 650
Northampton	1, 620	320	470	360	640	830
Onslow	4, 000	855	2, 075	735	2, 175	1, 705
Pamlico	300	60	50	105	40	50
Pasquotank	1, 325	325	525	350	675	300
Pender	2, 285	670	485	530	385	1, 350
Perquimans	990	300	165	445	450	195
Pitt	2, 385	445	485	600	285	1, 200
Robeson	2, 275	775	775	525	825	750
Sampson	3, 200	500	1, 700	500	1, 600	1, 250
Scotland	1, 800	450	600	450	950	525
Tyrrell	1, 170	340	235	485	395	400
Washington	1, 345	490	230	450	420	725
Wayne	4, 800	1, 400	1, 000	1, 400	1, 200	2, 400
Wilson	2, 655	750	450	575	705	850

the listed Coastal county distributions as to income sources have not undergone a similar degree of change since 1947. This assumption is supported by the following comparative data for 1947 and 1952 applicable to the entire State and the U. S.

PRINCIPAL SOURCES OF INCOME BY PERCENTAGE OF TOTAL

<u>INCOME SOURCE</u>	<u>N. C. - 1947</u>	<u>N. C. - 1952</u>	<u>U. S. - 1952</u>
Agriculture	19.1	15.4	6.7
Manufacturing	24.8	25.8	24.5
Trade, Services	21.7	22.9	25.6
Government	7.6	16.1	15.9
All Others	26.8	19.8	27.3

It will be noted that the "Government" source item changed materially during the five year interval; however, it is probable that the state-wide decrease shown for agricultural income was greater than that experienced by the lesser industrialized Coastal counties. In any case Table No. III-4 distributions are perhaps as nearly representative of actual present conditions as any data now available.

It will be noted in Table No. III-4 that the counties have been arranged in reverse order of per capita income as indicated by the third column which gives the relative rank of each with respect to the State's 100 counties. Thirty-five of the 41 Coastal counties show income below the average of \$860 for the entire State. Also, the favorable influence of military establishments upon the ranking of Craven, Cumberland and Onslow counties can be seen in the heavy "Government" contributions to income - 57.6, 42.2 and 51.6 per cent, respectively. The preponderance of agricultural income for most of the counties is also well illustrated.

TAXES:- North Carolina State government expenditures are met from three major sources: the General Fund, the Highway Fund and the Agriculture Fund. During fiscal 1952-53 the General Fund received approximately \$181,000,000 from the following principal tax sources:

GENERAL FUND TAX REVENUES - FISCAL 1952-53
(Receipts are in millions of dollars)

Corporate Income	38	Individual Income	37
Corporate Franchise	17	Sales Tax	55
Business Licenses	6	Beverage Tax	11
Insurance Company	7	Others	13

In addition to the above the General Fund collected nearly four million dollars in gas and oil inspection fees. The fund surplus was \$32,490,156 on June 30, 1953.

The Highway Fund is supported almost entirely by the seven cent gasoline tax and automobile registrations, receiving in fiscal 1953, about \$76,000,000 and \$22,000,000, respectively, from these sources. In addition, about \$47,000,000 in Federal funds were received. Of the seven cent gasoline tax, revenues equiva-

lent to one cent per gallon are specifically assigned to the support and liquidation of the \$200,000,000 bond issue of 1949. On the other hand a refund of five cents per gallon of the seven cents collected is made to applicants who certify that the gasoline involved was used in other than roadway vehicles, i. e., farm tractors, stationary motors, maritime craft, etc. For the 12 months period ending Sept. 30, 1953 over \$2,000,000 was refunded on this basis, the major portion of which (67%) was classified as pertaining to agriculture. Refund applications in the amount of \$133,570 (2,671,385 gals.) were honored from maritime interests, mostly small boat operators. In this connection it has been estimated that less than 25 per cent of the transient out-of-state pleasure craft owners take advantage of this refund privilege.

The Agriculture Fund operates on a much smaller budget (approximately \$2,000,000 in 1952-53) over one-fourth of which was advanced from the General Fund. Its other revenues are derived from various inspection and license fees, the fertilizer and feed taxes, etc. Of interest is the recently (Jan., 1952) inaugurated "Nickels for Know-How" assessment of five cents per ton on the sales of commercial feed and fertilizer. A total of over \$286,000 was collected during the first two years of the program. The proceeds are turned over to the Agricultural Foundation of N. C. State College and used in support of research programs.

Employment taxes, the current condition of the trust fund maintained by these taxes, and the State laws regulating their administration are all favorable to new industries locating in North Carolina. The average employment tax rate as applied by this State is among the lowest in the nation. In 1953 the estimated overall average rate for the 14,083 active employer accounts was 1.05 per cent of the taxable payroll. Although the federally required standard rate of 2.7 per cent is assigned initially reductions below this rate are extended to employers who qualify with favorable employment experience records during the previous three years. As a result, some 11,660 accounts were assigned rates below the 2.7 per cent standard and averaged .89 per cent. Of these, approximately 2400 accounts qualified for the minimum rate of 0.1 per cent. In terms of dollars the overall average unemployment insurance cost per worker in this State was \$31.50 based upon the 1953 average employer rate (1.05%) and the full \$3000 taxable wage base. It is reported that comparable insurance costs in some industrial states run as high as \$81.00. North Carolina's rating formula has been liberalized by each of the past three General Assemblies, yet the trust fund balance has continued to grow, reaching a total of \$175,750,000 by the end of 1952.

In North Carolina, as in most states, local governments derive the major part of their operating revenues from taxes on tangible property. However, local units have been able to hold these property taxes at a comparatively low level due to the fact that the State government has assumed the financial obligation for a major portion of the two most costly public services - schools and roads. In this respect there is, perhaps, no state comparable to North Carolina in the degree to which the responsibility for financing local government functions is discharged at the state level. Since 1933 the only local educational expenditure is that required to furnish and maintain the school buildings, and even on this item material help has been advanced from the General Fund surplus in the amounts of \$50,000,000

TABLE NO. III-3

ESTIMATED COUNTY POPULATIONS AND BUYING POTENTIALS AS OF DEC. 31, 1953

(Note:- First four columns are in thousands)

COUNTY	POPULATION	FAMILIES	GROSS CASH FARM INCOME	EFFECTIVE BUYING POWER			RETAIL SALES PER FAMILY
				TOTAL	PER CAP.	PER FAMILY	
Beaufort	37.4	9.3	27,747	15,444	742	2,984	3,145
Bertie	27.0	6.1	18,366	14,803	680	3,011	2,580
Bladen	30.6	6.8	19,811	10,283	647	2,913	2,127
Brunswick	20.3	4.6	12,905	4,714	636	2,805	862
Camden	5.3	1.4	4,079	2,796	770	2,914	731
Carteret	25.4	6.5	26,067	2,554	1,026	4,010	2,042
Chowan	12.9	3.0	10,604	4,340	822	3,535	2,436
Columbus	52.7	12.2	39,858	24,433	756	3,267	2,754
Craven	55.1	13.2	61,792	9,865	1,121	4,681	2,683
Cumberland	115.9	24.1	158,747	9,360	1,370	6,587	3,627
Currituck	6.3	1.8	5,599	3,248	889	3,111	1,220
Dare	5.5	1.3	5,006	33	910	3,851	2,578
Duplin	41.9	10.0	25,772	20,067	615	2,577	1,695
Edgecombe	52.7	12.1	50,071	24,890	950	4,138	2,943
Gates	9.7	2.3	5,468	4,186	564	2,377	1,043
Greene	18.2	3.8	13,214	18,191	726	3,477	1,321
Halifax	59.7	13.3	49,983	20,665	837	3,758	3,226
Harnett	49.7	11.8	44,929	22,230	904	3,808	2,455
Hertford	22.2	4.9	15,519	9,551	699	3,167	3,146
Hoke	16.1	3.4	9,028	6,240	561	2,655	1,774
Hyde	6.3	1.4	3,752	1,544	596	2,680	1,016
Johnston	67.1	16.2	50,779	35,533	757	3,135	2,297
Jones	11.0	2.5	7,074	6,795	643	2,830	848
Lenoir	48.2	11.5	44,454	19,623	922	3,866	3,782
Martin	28.9	6.2	19,289	17,205	667	3,111	2,621
Nash	62.0	14.4	56,780	30,538	916	3,943	3,431
New Hanover	70.6	20.0	84,382	2,503	1,195	4,219	3,859
Northampton	28.9	6.2	17,945	15,494	621	2,894	1,695
Onslow	55.3	10.9	68,962	7,463	1,247	6,327	2,087
Pamlico	10.4	2.6	7,454	3,367	717	2,867	774
Pasquotank	25.6	6.9	27,366	5,146	1,069	3,966	3,590
Pender	18.9	4.4	11,511	5,939	609	2,616	922
Perquimans	9.7	2.5	6,978	3,328	719	2,791	2,458
Pitt	65.3	15.0	57,598	36,514	882	3,840	3,253
Robeson	92.6	20.3	68,607	35,985	741	3,380	2,875
Sampson	51.3	11.9	31,665	22,217	617	2,661	1,698
Scotland	27.5	6.3	19,817	5,504	721	3,146	2,833
Tyrrell	5.2	1.2	3,393	1,623	653	2,828	1,278
Washington	13.6	3.1	11,876	2,391	873	3,831	2,394
Wayne	67.1	15.9	54,492	24,095	812	3,427	3,403
Wilson	55.5	13.4	57,946	28,613	1,044	4,324	3,215
State Total	4,289.1	1,063.3	4,572,201	915,832	1,066	4,300	2,943

The above are advance figures which appear in the May 10, 1954 issue of SALES MANAGEMENT, "Survey of Buying Power." Reproduced here by permission of the copyright owners.

TABLE NO. III-4

PERCENTAGE DISTRIBUTION OF COASTAL PLAIN COUNTY INCOME BY MAJOR SOURCES - 1947*

(Arranged in reverse order of per capita income)

COUNTY	PER CAP. INCOME	STATE RANK	AGR.	MFG.	CONS.	UTIL.	TRADE	FIN.	SERV.	GOV'T	MISC.	PROP.	OTHER
Camden	374	100	48.7	3.3	1.0	0.6	8.2	0.6	3.0	9.9	0.2	10.0	14.5
Pamlico	378	98	44.7	7.2	0.2	1.3	14.5	0.0	2.9	9.7	1.3	2.4	15.7
Brunswick	408	96	36.9	17.5	0.2	5.7	10.9	0.2	3.6	7.9	1.5	3.3	12.4
Pender	422	94	44.8	12.0	--	2.8	7.9	0.5	3.8	9.1	0.7	5.3	13.0
Carteret	476	86	21.3	12.9	2.3	1.5	19.9	0.7	8.7	8.1	2.1	9.8	12.7
Currituck	498	85	50.2	1.6	1.3	0.2	12.4	0.4	4.3	9.8	0.4	6.7	12.7
Hyde	505	82	41.1	1.6	0.2	2.0	13.6	0.7	4.0	11.5	0.7	9.7	14.8
Tyrrell	509	81	39.9	7.3	1.4	0.4	15.6	--	6.0	8.6	0.7	6.7	13.4
Dare	510	80	0.2	1.4	1.8	22.2	22.2	1.5	6.4	13.4	5.3	3.7	21.9
Northampton	560	76	53.7	5.2	0.6	1.0	11.5	0.9	3.9	5.5	0.4	9.7	7.6
Perquimans	562	75	41.2	11.1	0.7	0.8	14.0	0.8	4.7	6.7	0.7	10.8	8.6
Hoke	587	71	56.2	5.1	0.4	0.8	7.3	0.7	3.8	7.7	0.4	9.1	8.5
Bertie	588	70	53.9	4.8	0.9	0.3	11.1	0.6	3.2	5.6	0.4	11.2	8.0
Gates	590	69	52.5	8.8	0.3	1.4	7.1	1.3	2.1	6.9	1.0	9.4	9.2
Scotland	619	64	26.0	23.8	1.3	1.6	13.9	1.2	6.4	4.8	1.0	11.6	8.3
Bladen	620	63	48.8	16.7	0.9	0.7	9.8	0.6	4.1	5.1	0.8	5.5	7.1
Sampson	622	61	59.1	4.4	1.5	0.7	10.4	0.3	3.9	4.7	0.3	7.5	7.2
Martin	644	58	51.1	3.4	1.2	3.3	12.5	0.5	4.1	5.4	0.4	10.7	7.4
Jones	646	57	66.7	2.9	0.4	0.3	5.4	0.2	2.2	5.2	3.6	5.0	8.2
Columbus	656	55	53.2	4.7	1.7	1.4	14.2	0.9	4.2	4.6	0.7	6.2	8.3
Robeson	668	53	43.6	12.6	1.5	1.3	13.1	0.9	5.8	4.3	0.7	9.0	7.2
Beaufort	675	52	39.8	7.1	2.5	1.3	18.2	0.9	6.3	5.5	1.2	8.5	8.7
Hertford	706	47	40.4	12.3	1.6	1.1	17.4	0.6	5.7	4.6	0.8	9.6	6.0
Duplin	714	46	62.4	4.5	0.8	0.9	9.7	0.4	2.9	4.4	0.3	6.4	7.3
Chowan	725	44	30.9	13.0	3.5	3.7	12.2	1.3	4.4	13.8	0.8	8.9	7.5
Onslow	729	43	18.8	1.8	4.0	0.7	7.8	0.3	6.6	51.6	0.4	3.0	5.0
Harnett	730	42	45.3	15.8	1.4	0.4	11.1	0.8	5.0	4.0	0.7	7.9	7.7
Johnston	731	41	53.0	8.5	1.4	2.1	10.7	0.8	4.1	3.7	0.5	8.3	7.1
Halifax	760	40	29.3	28.2	1.5	2.9	12.7	1.1	4.7	4.1	1.1	7.7	6.7
Wayne	762	38	30.7	12.8	4.7	2.2	19.4	1.5	6.9	5.4	0.9	8.6	7.0
Lenoir	778	36	35.5	10.9	4.9	0.5	16.4	1.7	7.1	4.8	0.8	10.0	7.4
Washington	796	33	14.9	44.1	5.9	0.8	10.4	0.3	5.4	4.2	1.5	4.6	7.9
Pasquotank	816	28	10.7	18.0	2.8	4.0	20.2	3.0	8.6	11.0	1.1	12.9	7.7
Pitt	816	27	43.9	7.3	1.7	0.9	15.5	1.6	5.9	5.1	0.6	10.8	6.8
Greene	832	24	73.2	0.9	0.1	0.1	5.2	0.2	1.3	3.8	0.1	9.3	5.7
Edgecombe	882	20	33.3	7.3	3.3	14.0	12.6	1.8	6.6	4.2	0.9	9.4	6.6
Wilson	886	19	37.7	10.6	2.8	1.9	15.8	2.1	6.4	4.1	0.8	11.1	6.8
Nash	888	18	40.4	11.5	2.8	7.5	12.9	1.2	4.6	3.4	0.9	8.3	6.5
Cumberland	971	12	10.6	8.8	4.3	2.3	13.1	1.0	7.0	42.2	0.8	4.6	5.3
New Hanover	1,061	8	3.0	10.8	4.9	19.2	20.7	2.9	10.0	8.1	1.5	11.3	7.7
Craven	1,100	6	13.2	4.2	1.7	1.5	8.2	0.7	4.2	57.6	0.4	3.5	4.8
State	860		19.1	24.8	3.5	4.2	14.6	2.1	7.1	7.6	1.4	8.4	7.2

in past allocations and another \$50,000,000 authorized in October, 1953. Of the \$125,000,000 spent on the public school system in fiscal 1951-52 only \$18,300,000 came from local funds, whereas the State contributed \$95,300,000 and the remainder (\$11,400,000) came from Federal sources. Similarly the State's assumption in 1931 of responsibility for the construction and maintenance of the entire road system, except most city streets, has lightened materially the financial load on counties. Even those city streets which are part of the State road net are maintained by the State Highway Commission. Also, one half cent per gallon of the seven cent gas tax (amounting to over \$5,000,000 in 1953) is distributed annually among some 400 cities and towns on the bases of population and street mileage.

The effective rates of local property taxes vary greatly among the counties, with a weighted average of about \$1.00 per \$100 of assessed valuation. The assessment ratios also vary considerably in different counties and municipalities but generally fall between about 30 and 50 per cent of the actual value of the property. The combined rate for both county and municipal taxes may vary from a low of \$1.19 per \$100 of the assessed valuation to a high of \$4.60, with a state-wide weighted average of \$1.94. Twenty-five counties have actually reduced their rates since 1933 when the present tax structure was set up. Of these 25 eight Coastal Plain counties reduced their rates by the following percentages: Bertie (10.0); Dare (39.3); Duplin (17.1); Johnston (17.2); Martin (15.0); Onslow (1.1); Pasquotank (18.4); Washington (10.0).

In the Coastal Plain, county indebtedness, consisting of bond issues, State school loans, and bond or revenue anticipation notes, varies greatly from a low of \$5000 for Gates County to a high of \$3,413,000 for Robeson. Such indebtedness for all counties of the State amounted to a total of \$141,823,818 as of June, 1953. Municipal bond issues had a state-wide total of nearly \$175,000,000 in June, 1952. Of the 12 Coastal Plain cities exceeding 5000 population, bonded indebtedness varied from about \$17.00 per capita for Tarboro to a maximum of \$172.00 for Wilson and Greenville (based on 1950 census and June, 1952 obligations).

BANKING AND CREDIT:- Operating under similar regulatory restrictions and generally recognized banking policies as to risk capital, North Carolina banks are in a position, either by direct loans or through correspondent banks, to meet farm credit needs and capital services to new or expanding business, at least comparable to similar facilities available in other southern states. Aside from the fact that the larger corporations, with greater concentration in the Piedmont, tend to meet their capital requirements in out-of-state banking centers, few contrasts can be drawn between the Coastal Plain and the remainder of the State.

On June 30, 1953 there were 180 state banks with 230 branches and 46 national banks with 21 branches operating in North Carolina with total resources in excess of two billion dollars. In addition to commercial banks there are some 20 industrial banks which take care of the needs of workers for small loans at reasonable interest rates prescribed by law.

During recent years a number of local organizations in the nature of "development corporations" have been set up for the purpose of attracting new industry. Assistance to the latter usually takes the form of providing sites and physical plant such as factory buildings, warehouses, grain elevators, etc., with long-term lease privileges extended to the new company. In many cases these development corporations may be adjuncts to, and work closely with, local Chambers of Commerce. Base capital is obtained through public subscription with arrangements for subsequent participation by life insurance companies or other investment sources. In the State as a whole at least 26 communities have organized such development corporations and carried out actual construction or other development projects. Of these, 13 are in the Coastal Plain and according to latest information (Jan., 1954) include the following towns and cities: Ahoskie, Clinton, Dunn, Fairmont, New Bern, Rich Square, Robersonville, Rocky Mount, Salem-burg, Warsaw, Washington, Whiteville, and Wilmington. In addition, 11 communities in the Coastal Plain have set up development corporations and are ready to participate in suitable programs and 20 other towns are prepared to organize when appropriate projects are presented. For the entire State at least 116 communities have, or are prepared to participate in this type of promotion. It is probable that other communities may soon set up similar facilities to fill a role in the credit structure which lies beyond the normal scope of commercial bank operations.

A related practice has been followed involving direct participation by some counties whereby storage, or similar facilities, are built and leased to private enterprise. The program is financed through the issuance of non-tax-exempt county revenue bonds at somewhat higher interest rates than applicable to regular issues since the county's credit is involved only to the extent earnings from rentals are able to meet scheduled payments. The occupying firm frequently arranges to purchase a part or all of the bond issue.

So far as can be determined there are no North Carolina banks which maintain industrial departments staffed by technical specialists, such as are provided in many of the larger northern institutions and The Bank of America in California. (It is understood that at least one large Jacksonville, Florida, bank furnishes this service). The advice of these specialists need not be limited to initial loan considerations but should be used as a continuing service to clients. A Federal lending agency - Small Business Administration - has expressed the opinion that southern banks could possibly lend a needed service to industry if at least a few of the larger institutions retained such staff experts who would assist not only the employing bank, but also its correspondents and others on a fee basis. The Small Business Administration maintains such departments in its regional offices. With loans limited to a maximum of \$150,000 it cannot cover industrial financing in the intermediate and higher brackets.

IV. AGRICULTURE

The subject matter of this section is confined to the broader aspects of the several pursuits generally classified as agricultural. Data on the more important products of the farm are presented only to the extent which may indicate trends and geographical distribution. Emphasis is given to those matters which appear to have, or may be made capable of having, a critical influence upon the economic patterns of the Coastal Plain.

North Carolina is, indeed, rich in those human and natural resources which support and condition an agrarian economy. Although striking advances have been made during the past few decades, recent studies (State Agricultural Mobilization Committee - 1951) indicate that there are undeveloped potentials which equal, or even exceed, those presently enjoyed.

The relationship between the basic elements involved and the means by which the products of the soil are brought forth suggests the following order of presentation under these general headings:

- | | | |
|-------------------|--------------------------|------------------------------|
| 1. The People | 5. Livestock and Poultry | 9. Processing and Marketing |
| 2. The Land | 6. Farming Techniques | 10. Storage Facilities |
| 3. Weather Factor | 7. Mechanization | 11. Income and Credit |
| 4. The Crops | 8. Farm Tenure | 12. Research and Development |

THE PEOPLE: North Carolina's four million people are divided almost equally among the urban, rural non-farm and rural farm areas, as these residential classifications are defined and applied by the Bureau of the Census. The rural farm segment has shown a consistent downward trend since 1930, when a little over 50 per cent of the State's population was so listed. For those actually employed in 1950 about 360,000 persons were engaged in agriculture as compared to 409,000 in industry. In the Coastal Plain this relationship is reversed, where there were three times as many workers (188,000) in agriculture than employed in industry. Although specific data are not available it is probable that at least two-thirds of the State's population are directly dependent upon, or closely associated with, agricultural pursuits.

The downward trends in both farm population and farm workers have been, in some respects, beneficial, particularly if they stem from increased mechanization and improved farming techniques. Such of this diversion as has been absorbed by industry, trade, and other services, locally or within the State, tends toward a better balancing of its economy. On the other hand a large portion of those who have left agriculture have migrated to other states. Since this emigrating group contains a high proportion of younger people a corresponding rise in the percentage of dependents, i. e., the very young and the very old, results in the residual farm population. For instance, only 32 per cent of the urban population are under 14 or over 65 years of age as compared to 43 per cent of those classed as rural farm. These realignments have particular significance in most of the Coastal Plain counties, where both losses and percentages of farm population are high.

THE LAND: The contributory roles played by North Carolina's soils and weather have been generally favorable to agriculture. In addition to vast acreages of varied fertility and type, now in cultivation, the State possesses extensive reserves of potential farm lands for future use, mostly in the form of timber and woodland tracts, now comprising some 60 per cent of its total area. It has been estimated that the acreage of cropland, now 7,700,000, could be nearly doubled through proper management. A major portion of this potential cropland is found in the low-lying areas of the Coastal Plain, much of which would have to be drained. Some of this land should be brought into production to replace marginal tracts on which cultivation cannot be properly maintained. The 1951 committee survey listed over 444,000 acres in the State now being cultivated which should be converted to trees or grass.

In addition to the potentially cultivable lands in the Coastal Plain extensive swamps and salt marshes occur with frequent peat and muck deposits. In their natural state they support various timber species, scrub growths, and marsh grasses. A special problem exists in the Coastal Plain with respect to some four and a half million acres of fine-textured soils which tend to clod, pack or bake. Usually, these heavy soils lack drainage, and may drain slowly even when ditched and tiled. Some drainage treatment has been established on 545,000 acres in the Coastal Plain and more could be brought into production in this manner. With drainage, plus sufficient applications of lime, pasture can be developed on much of this wasteland. A large scale venture with a view to stock raising is now in progress in eastern Carteret County, involving some 48,000 acres.

The deep, sandy soils in the "Sandhills," or southwestern part of the Coastal Plain, pose an opposite problem. They are droughty and leach readily. Such soils are better adapted to timber and pulpwood growth than for cropping. The well drained sandy-loams and other types of loam soils in the Coastal Plain are suited to a wide range of row crops. They retain moisture well and are not subject to soil erosion.

WEATHER FACTOR: Climatically North Carolina is strategically situated, with conditions ranging from near semi-tropic in the southeast to temperate in the north and mountain portions of the State. There are few crops, normal to the country as a whole, which cannot find here a favorable environment. The long frost-free growing season, averaging 216 days in the Coastal Plain, is important. It not only permits a wider choice of crop types but also improves yields, by allowing more latitude in selecting optimum dates for planting and harvesting. It has encouraged profitable double-cropping practices with, in some instances, three or even four crops grown from the same land in a single year. The relatively mild climate generally prevailing in the State has a most important bearing upon livestock production, both as to winter grazing versus cut forage feeding, and the elimination of expensive protection against cold weather such as is needed in the northern and western parts of the country. The State has yet to capitalize fully on this important advantage in all phases of animal husbandry.

Rainfall during normal years is adequate and seasonally well distributed. Average frequency and intensity during the growing season approach the optimum

in some sections of the State. However, the repetition of somewhat exceptional drought periods during the past four years has made many farmers irrigation conscious. With generally plentiful surface and ground water sources available, supplemental irrigation gives promise of assuming an increasingly more important role in certain sections of the State.

It might be noted that these recent periods of sub-normal rainfall, beginning in the fall of 1949, have, in their adverse effects upon many crops, considerably reduced the comparative value of production data for the years 1949-53. In some extreme cases statistics from more representative years have had to be used in this report.

THE CROPS: With a land area of about 31,451,000 acres North Carolina has about 19,318,000 acres, or 62 per cent, in farms. However, less than half (7,700,000 acres) are classified as cropland, most of the remaining acres being woodland.

Although production may vary considerably from year to year for the different crops the acreages planted show somewhat more uniformity during recent years. The Federal crop control program has been a contributing factor in this regard. These acreage data are relatively less significant, economically, than crop value. For instance corn, cotton, small grains and pasture together, occupy over half the total cropland, yet their combined contribution to cash income is less than that for tobacco which is grown on only about 8 per cent of this land. The following percentages of total cropland are rough approximations of acreages planted to the principal crops in the entire State during recent years (1949 actual).

PERCENTAGE OF TOTAL CROPLAND BY PRINCIPAL CROPS

Corn	27	Small Grains	8
Cotton	11	Truck, Hay & Others	18
Tobacco	8	Pasture	10
Peanuts	3	Idle	15

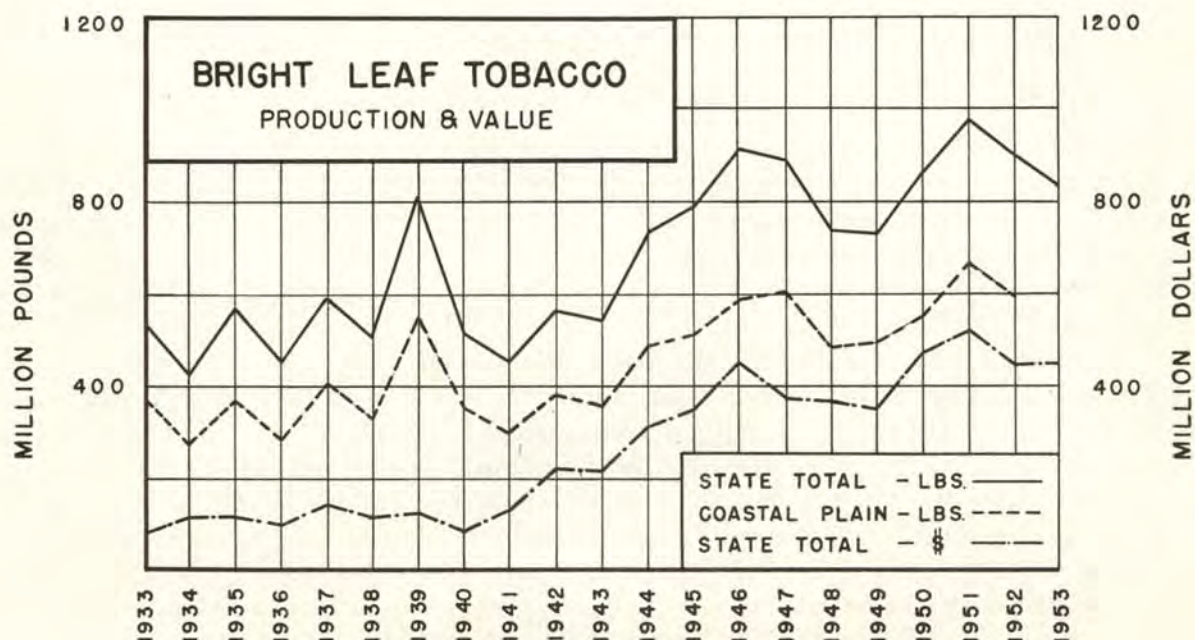
The only pronounced trends evident during the last 25 years in acreages planted to the major crops are: cotton and sweet potatoes have decreased by half; soybeans have trebled; oats and hay have doubled; and lespedeza seed planting has increased from practically nothing in 1930 to over 100,000 acres in recent years. The total number of acres actually harvested has remained nearly static at around 6,000,000.

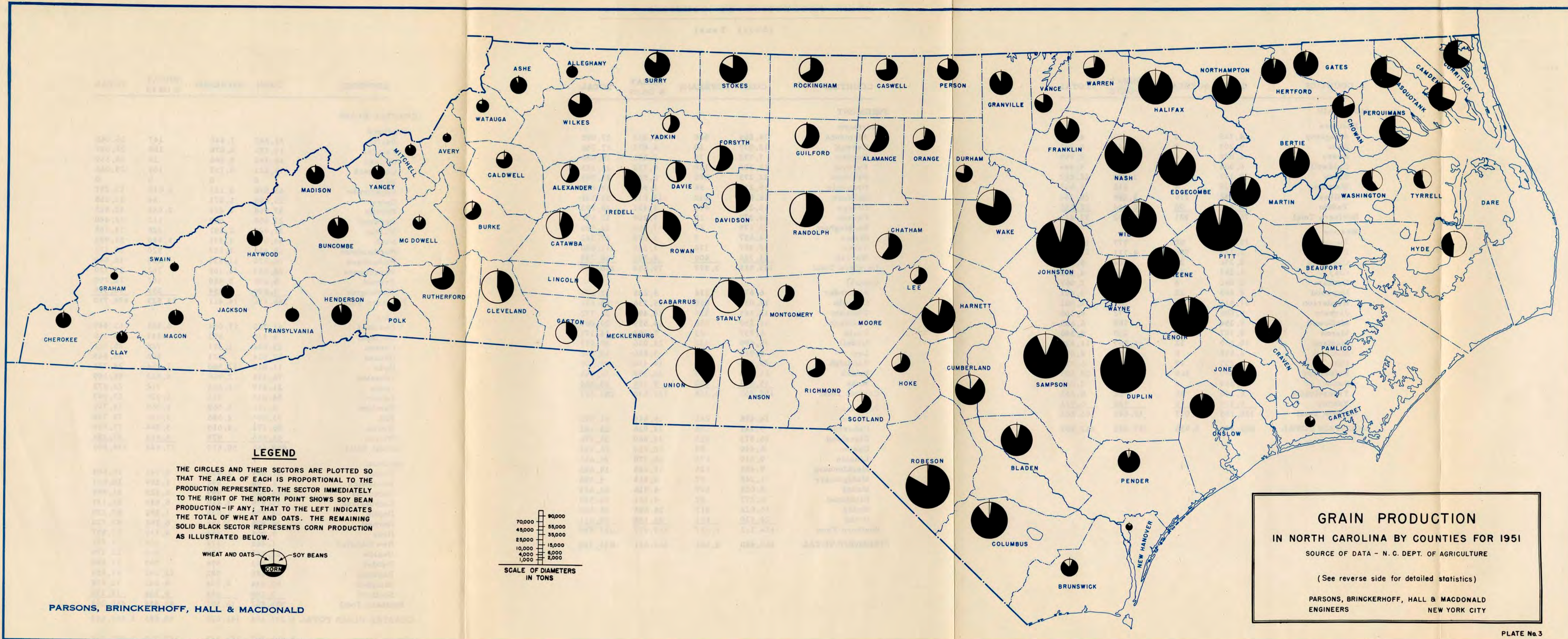
The state-wide distribution of production for the principal crops are shown graphically on Plate Nos. 3 and 4, where concentrations in the Coastal Plain are well illustrated. Supporting data for these Plates are listed on the reverse side thereof. A more significant measure of the relative economic importance of the various crops is that based upon value. The following table presents these data, applicable to both the State as a whole and the Coastal Plain. The agricultural dominance of the latter is obvious. (It should be noted that fruits and vegetables with a total value of \$22,429,000 have been omitted from this table because of the unavailability of data with respect to the Coastal Plain's contribution).

PRINCIPAL AGRICULTURAL PRODUCTS - 1951
(Value Expressed in Thousands of Dollars)

PRODUCT	STATE VALUE	COASTAL PLAIN	
		VALUE	PER CENT
Tobacco	534,930	365,802	68.5
Cotton-Lint	105,019	70,681	67.3
Corn	111,558	70,640	63.4
Peanuts	38,714	38,464	99.4
Soybeans	13,204	12,215	92.5
Hay	37,600	10,105	26.9
Sweet potatoes	10,921	8,106	74.1
Irish potatoes	8,358	5,010	59.9
Oats	12,165	3,319	27.3
Wheat	18,934	2,728	14.4
Lespedeza seed	2,816	341	12.1
Total	894,219	587,411	65.7

TOBACCO: The importance of this crop to the economy of North Carolina needs no confirmation here. Suffice it to say that of the total U.S. production of flue-cured tobacco (otherwise known as Bright Leaf, and the principal ingredient of most American cigarette blends) this State contributes about 80 per cent, or some 1,000 million pounds annually, of which about 700 million pounds come from the Coastal Plain. Production of Burley tobacco is confined to the Mountain Region and amounts to about two per cent of the State's total of all types. The trend in Bright Leaf production in the State and in the Coastal Plain since 1933, and crop values, are shown graphically below.





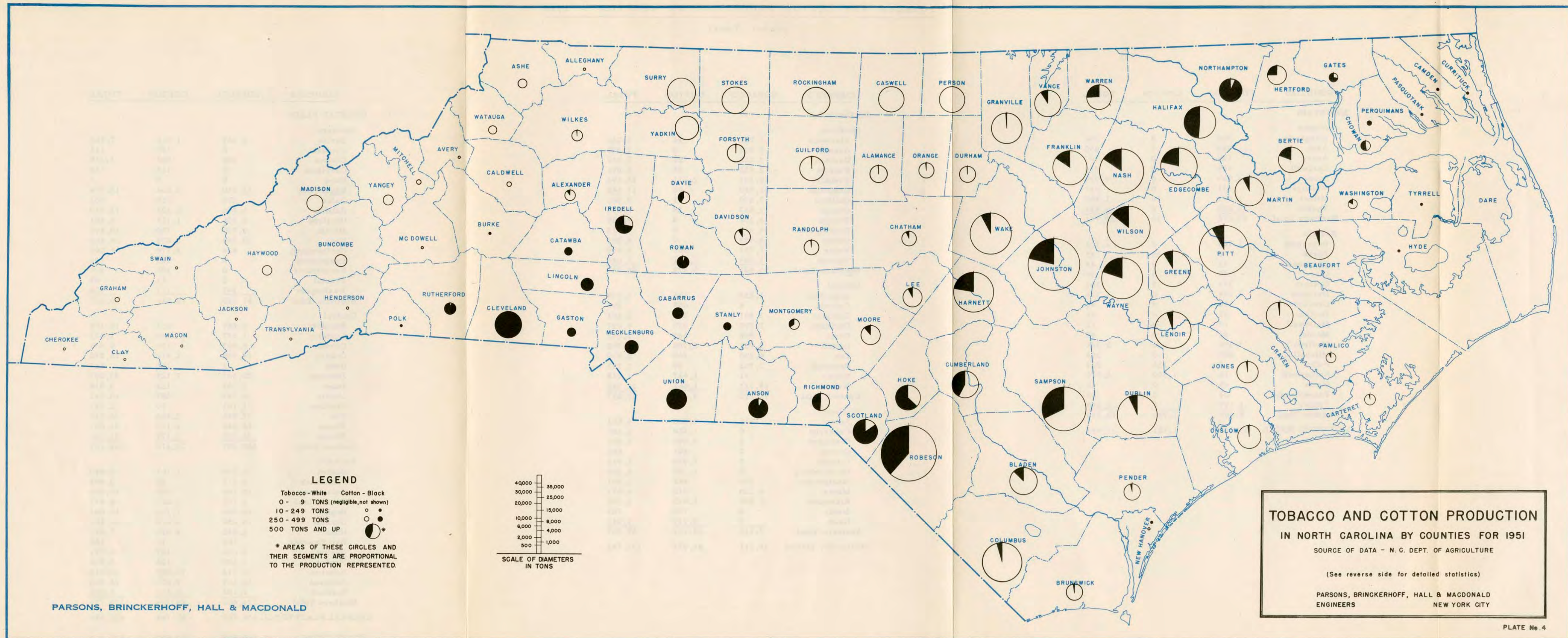
GRAIN PRODUCTION BY COUNTIES - 1951

(Short Tons)

COUNTIES	CORN	SOYBEANS	WHEAT & OATS	TOTAL
MOUNTAIN				
Northern				
Alleghany	4,325	0	455	4,780
Ashe	9,202	0	645	9,847
Avery	1,848	4	317	2,169
Caldwell	6,584	525	2,337	9,446
Surry	19,177	82	3,223	22,482
Watauga	4,928	4	915	5,847
Wilkes	16,782	216	3,286	20,284
Yadkin	12,442	90	10,024	22,556
Northern Total	75,288	921	21,202	97,411
Western				
Buncombe	15,298	50	977	16,325
Burke	7,133	750	4,111	11,994
Cherokee	8,276	25	204	8,505
Clay	4,297	40	233	4,570
Graham	2,042	4	21	2,067
Haywood	8,860	12	529	9,401
Henderson	11,910	63	589	12,562
Jackson	6,086	8	72	6,166
McDowell	5,254	562	789	6,605
Macon	8,107	59	220	8,386
Madison	10,210	12	1,067	11,289
Mitchell	3,698	0	359	4,057
Polk	5,233	17	1,129	6,379
Rutherford	14,390	360	5,756	20,506
Swain	2,840	0	4	2,844
Transylvania	6,146	55	52	6,253
Yancey	6,405	0	528	6,933
Western Total	126,185	2,017	16,640	144,842
MOUNTAIN TOTAL	201,473	2,938	37,842	242,253

COUNTIES	CORN	SOYBEANS	WHEAT & OATS	TOTAL
PIEDMONT				
Northern				
Alamance	14,863	820	11,322	27,005
Caswell	13,039	30	4,677	17,746
Durham	7,772	71	2,193	10,036
Forsyth	12,305	136	9,712	22,153
Franklin	22,273	902	2,528	25,703
Granville	18,216	58	1,580	19,854
Guilford	18,897	240	13,617	32,754
Orange	12,292	479	5,421	18,192
Person	14,377	15	3,209	17,601
Rockingham	15,175	49	7,564	22,788
Stokes	14,637	7	3,098	17,742
Vance	10,327	170	1,383	11,880
Warren	11,740	400	4,590	16,730
Northern Total	185,913	3,377	70,894	260,184
Central				
Alexander	6,673	314	5,288	12,275
Catawba	12,036	919	15,136	28,091
Chatham	15,143	136	10,493	25,772
Davidson	14,350	158	14,559	29,067
Davie	6,737	43	7,391	14,171
Iredell	15,499	422	23,036	38,957
Lee	6,913	62	3,836	10,811
Randolph	23,562	371	18,436	42,369
Rowan	13,533	273	22,350	36,156
Wake	35,809	650	9,105	45,564
Central Total	150,255	3,348	129,630	283,233
Southern				
Anson	14,498	248	16,849	31,595
Cabarrus	9,141	175	14,026	23,342
Cleveland	15,973	123	19,880	35,976
Gaston	6,440	59	10,234	16,733
Lincoln	9,510	175	16,770	26,455
Mecklenburg	9,455	123	10,245	19,823
Montgomery	5,248	97	4,013	9,358
Moore	8,628	109	4,916	13,653
Richmond	8,277	82	4,161	12,520
Stanly	14,622	313	24,685	39,620
Union	22,520	153	34,138	56,811
Southern Total	124,312	1,657	159,917	285,886
PIEDMONT TOTAL	460,480	8,382	360,441	829,303

COUNTIES	CORN	SOYBEANS	WHEAT & OATS	TOTAL
COASTAL PLAIN				
Northern				
Bertie	33,482	1,416	147	35,045
Camden	19,181	8,676	180	28,037
Chowan	14,755	3,566	38	18,359
Currituck	19,223	9,737	105	29,065
Dare	0	0	0	0
Edgecombe	45,556	5,123	2,618	53,297
Gates	23,443	1,071	54	24,568
Halifax	37,768	2,421	2,634	42,823
Hertford	21,658	669	113	22,440
Martin	31,689	2,191	228	34,108
Nash	44,971	1,331	5,680	51,982
Northampton	29,414	1,837	920	32,171
Pasquotank	24,976	11,334	230	36,540
Perquimans	24,453	13,105	162	37,720
Tyrrell	6,658	5,480	161	12,299
Washington	9,609	6,454	253	16,316
Northern Total	386,836	74,411	13,523	474,770
Central				
Beaufort	41,760	17,034	4,655	63,449
Carteret	3,430	593	143	4,166
Craven	23,602	2,391	728	26,721
Greene	37,514	423	508	38,445
Hyde	11,010	12,580	1,164	24,754
Johnston	78,318	2,969	4,822	86,109
Jones	21,417	1,443	712	23,572
Lenoir	54,238	833	1,976	57,047
Pamlico	8,265	5,368	1,068	14,701
Pitt	73,264	2,385	3,135	78,784
Wayne	66,172	3,618	3,804	73,594
Wilson	41,466	975	4,813	47,254
Central Total	460,456	50,612	27,528	538,596
Southern				
Bladen	31,469	1,452	2,743	35,664
Brunswick	8,768	594	1,289	10,651
Columbus	45,545	999	5,325	51,869
Cumberland	23,879	3,410	5,848	33,137
Duplin	63,706	1,625	1,889	67,220
Harnett	34,804	1,352	6,564	42,720
Hoke	8,054	334	4,119	12,507
New Hanover	1,443	174	124	1,741
Onslow	21,348	575	256	22,179
Pender	16,433	598	769	17,800
Robeson	57,285	582	11,692	69,559
Sampson	63,834	4,354	4,682	72,870
Scotland	7,294	548	4,534	12,376
Southern Total	383,862	16,597	49,834	450,293
COASTAL PLAIN TOTAL	1,231,154	141,620	90,885	1,463,659
STATE TOTAL	1,893,107	152,940	489,168	2,535,215



TOBACCO AND COTTON PRODUCTION BY COUNTIES - 1951

(Short Tons)

COUNTIES	TOBACCO	COTTON	TOTAL
MOUNTAIN			
Northern			
Alleghany	204	0	204
Ashe	950	0	950
Avery	107	0	107
Caldwell	409	9	418
Surry	9,939	0	9,939
Watauga	831	0	831
Wilkes	1,413	16	1,429
Yadkin	6,825	8	6,833
Northern Total	20,678	33	20,711
Western			
Buncombe	1,703	0	1,703
Burke	0	25	25
Cherokee	43	0	43
Clay	56	0	56
Graham	313	0	313
Haywood	1,274	0	1,274
Henderson	34	0	34
Jackson	91	0	91
McDowell	12	0	12
Macon	42	0	42
Madison	3,322	0	3,322
Mitchell	395	0	395
Polk	0	225	225
Rutherford	16	1,500	1,516
Swain	45	0	45
Transylvania	24	0	24
Yancey	1,199	0	1,199
Western Total	8,569	1,750	10,319
MOUNTAIN TOTAL	29,247	1,783	31,030

COUNTIES	TOBACCO	COTTON	TOTAL
PIEDMONT			
Northern			
Alamance	3,722	24	3,746
Caswell	7,898	0	7,898
Durham	3,212	28	3,240
Forsyth	3,858	35	3,893
Franklin	12,157	2,437	14,594
Granville	11,550	90	11,640
Guilford	7,470	33	7,503
Orange	2,827	28	2,855
Person	8,309	0	8,309
Rockingham	9,913	0	9,913
Stokes	8,993	0	8,993
Vance	7,783	767	8,550
Warren	5,709	1,937	7,646
Northern Total	93,401	5,379	98,780
Central			
Alexander	1,234	145	1,379
Catawba	4	695	699
Chatham	2,461	200	2,661
Davidson	2,799	258	3,057
Davie	958	685	1,643
Iredell	1,052	2,700	3,752
Lee	4,230	360	4,590
Randolph	2,703	50	2,753
Rowan	31	1,687	1,718
Wake	19,723	1,662	21,385
Central Total	35,195	8,442	43,637
Southern			
Anson	336	4,325	4,661
Cabarrus	0	1,450	1,450
Cleveland	2	8,800	8,802
Gaston	2	863	865
Lincoln	0	1,925	1,925
Mecklenburg	0	2,250	2,250
Montgomery	836	445	1,281
Moore	4,156	515	4,671
Richmond	1,883	1,825	3,708
Stanly	0	705	705
Union	0	5,049	5,049
Southern Total	7,215	28,152	35,367
PIEDMONT TOTAL	35,811	41,973	177,784

COUNTIES	TOBACCO	COTTON	TOTAL
COASTAL PLAIN			
Northern			
Bertie	6,383	1,525	7,908
Camden	8	105	113
Chowan	528	588	1,116
Currituck	0	125	125
Dare	0	0	0
Edgecombe	13,050	3,524	16,574
Gates	252	650	902
Halifax	6,546	6,224	12,770
Hertford	3,356	1,125	4,481
Martin	9,706	790	10,496
Nash	20,548	3,875	24,423
Northampton	434	5,774	6,208
Pasquotank	0	105	105
Perquimans	0	395	395
Tyrrell	2	83	85
Washington	797	157	954
Northern Total	61,610	25,045	86,655
Central			
Beaufort	9,659	535	10,194
Carteret	1,377	45	1,422
Craven	8,863	188	9,051
Greene	14,598	1,412	16,010
Hyde	2	145	147
Johnston	26,567	7,125	33,692
Jones	5,705	133	5,838
Lenoir	16,034	887	16,921
Pamlico	1,101	90	1,191
Pitt	27,936	2,400	30,336
Wayne	16,846	4,175	21,021
Wilson	20,005	3,275	23,280
Central Total	148,693	20,410	169,103
Southern			
Bladen	8,275	1,165	9,440
Brunswick	3,315	88	3,403
Columbus	19,109	850	19,959
Cumberland	5,152	3,825	8,977
Duplin	18,506	1,375	19,881
Harnett	15,650	4,450	20,100
Hoke	2,892	4,925	7,817
New Hanover	169	19	188
Onslow	6,626	147	6,773
Pender	3,200	120	3,320
Robeson	23,814	15,000	38,814
Sampson	16,627	7,875	24,502
Scotland	1,152	6,450	7,602
Southern Total	124,487	46,289	170,776
COASTAL PLAIN TOTAL	334,790	91,744	426,534
STATE TOTAL	499,848	135,500	635,348

It should be noted that tobacco production in this State has been under Federal acreage control since 1933, except during 1937 and 1939. Peak production in the latter year resulted in depressed prices and subsequent restoration of controls by vote of the producers. Total acreage planted during 1951 and 1952 remained static at 747,000.

Again, the important consideration here is the trend in yields. These have practically doubled since 1930 (757 lbs. per acre to about 1350 for the past few years). Among the contributing factors have been: improved fertilizing techniques; disease, pest and weed control; crop rotation; introduction of "Black Shank," "Granville Wilt" and "Blue Mold" resistant types, and use of certified seeds. Further improvements are inevitable; for instance many tobacco growers continue to use old-line, heavy-bodied varieties in spite of lower returns per acre.

COTTON: This crop, though important, has never occupied the predominant position in the agricultural economy of North Carolina as it has in other southern states. As measured by acreages planted it has followed a generally downward trend since 1926, from about 1,800,000 acres to less than one-third that amount in 1950. Both production and yield data for the past 10 years or more have been erratic to the point of being meaningless except, perhaps, to invite attention to the various vicissitudes to which this crop is subject. For instance, estimates are available for North Carolina of the ratio each year's yield bears to a hypothetical full yield, expressed as a percentage. Since 1927 the latter has varied from a low of 31 per cent in 1950 to a maximum of 93 per cent in 1940. The several adverse factors contributing to the deficiency in yield are also individually estimated by percentages. They are as follows, together with the year in which each took its maximum toll: deficient moisture - 14 per cent in 1936; excessive moisture - 15 per cent in 1929; other climatic conditions - 4 per cent in 7 years out of 24; plant diseases - 3 per cent in 1938; Boll Weevil - 54 per cent in 1950; other insects - 5 per cent in 1927. The Boll Weevil attack of 1950 was largely responsible for an average State yield of only 151 pounds per acre that year. It is probable that relatively little further improvement in yields will be made since practically 100 per cent of the cotton acreage in the State is already receiving recommended fertilizer treatment as compared to about 50 per cent for the United States as a whole.

CORN: With respect to acreage planted this crop greatly exceeds all others in the State, averaging about 2,250,000 acres for the past 20 or 30 years, with relatively small deviations. Production for the ten year period 1941-50 averaged about 60,000,000 bushels annually, reaching a high of 74,184,000 in 1950. Production data for 1951 and 1952 reveal the effects of drought conditions during those years.

It is important to note that, although acreage has remained almost static, production has consistently increased over the past 20 years, from about 18 bushels per acre in 1930 to 33 bushels in 1950. Aside from generally improved farming practices one of the most important contributing factors to better yields has been the introduction, and increasing use of hybrid seed. Although the percentage of total acres planted with hybrids is growing steadily, and had reached 42 per

cent by 1952, North Carolina is far behind most of the leading corn producing states, which are approaching, or have arrived at, the 100 per cent usage mark. The close relationship between these hybrid usage percentages and average yields per acre in other states is indicative of the margin of potential betterment yet to be developed in North Carolina. In some tests made in this State hybrids have outyielded open-pollinated lines by 20 to 30 bushels per acre. In 1950-51 the highest yield in the State was reported in Currituck County - 45.1 bushels per acre. The lowest yield, also in the Coastal Plain, occurred in Scotland County with an 18.9 average.

SMALL GRAINS: Although nearly a million acres are planted to these crops, the areas of major production are in the Piedmont Plateau (about 18 million bushels) with the Coastal Plain contributing a much lesser portion (less than 6 million). Of the several classes of grain included - oats, wheat, rye, barley, sorghum, etc., - only the first two are of significant importance. Yields are fair in good years and show considerable betterment during the past two decades, particularly with respect to oats which increased from 18.5 bushels per acre in 1930 to 35.5 in 1951. Though Coastal Plain total production is much lower than in the Piedmont, per acre yields in the former have equaled or exceeded those of the latter, at least during the past few years.

SOYBEANS: This crop is particularly important to the Coastal Plain, where about 90 per cent of the State's production is found, largely concentrated in the northeastern Tidewater counties. Acreages have increased steadily from about 70,000 in the 1920's to over 300,000 in 1951. There is also a healthy improvement in yields - from 10.5 bushels in 1930 to 17 in 1950 - however, additional increases are probable. Recent tests showed that 38 per cent of the fields tested needed from 2000 to 3000 pounds of lime per acre, the legumes being heavy users of this soil conditioner.

Due to the wide range of possible uses for this plant, soybean production is destined to have an increasingly more important place in the economy of the Coastal Plain since both domestic and foreign markets are expanding rapidly. Increased local processing and milling facilities with better competitive markets and improved grading should materially increase its value as a cash crop. Very little of the present production, other than soybean hay, is kept on the farms as feed.

PEANUTS: As with soybeans, peanut production is especially important to the Coastal Plain, where over 99 per cent of the State's total is found, largely concentrated in the northern counties. Value of the 1951 crop was nearly \$39,000,000 from about 237,000 acres (top year - 1945 with about 320,000 acres). Planting was reduced to 175,000 in 1953 by Federal crop control directives. Average State yields have increased from 870 pounds per acre in 1930 to nearly 1400 in 1951; in Gates County yields exceeded 1620 lbs. Further yield improvements should follow through reduced row spacing - 36 inches to 24 or 18 inches - with consequent better weed control; increased interplanting; improved fertilization techniques; and crop rotation. Peanuts are an example of a crop which is "hard" on land. They remove so much potash from the soil that it is difficult to maintain

yields even with a two-year cotton-peanuts rotation. A longer rotation period with frequent use of cover crops, is a promising trend. Nearly all of the crop was threshed and sold; however, peanut hay, sometimes enriched with additives such as molasses, is becoming an important factor in stock feeding. Production exceeded 160,000 tons in 1951, or about three-quarters of a ton per acre.

HAY CROPS: Measured by acres planted, hay crops of all types rank second only to corn in the State and have remained static at about 1,200,000 acres for the past few years. This is exclusive of that part of the Lespedeza crop grown for seed production, relatively little of which is found in the Coastal Plain. Lespedeza hay production alone is approximately equal to that of all other types - alfalfa, clover, timothy, soybean, cowpeas, peanut, grain and others. Less than one-third of the State's total production occurs in the Coastal Plain. Yields show some increase with further improvement probable as a result of better seed control and expanded use of fertilizers. Over 90 per cent of the hay crop was fed to livestock on the producing farm.

POTATOES: About two-thirds of North Carolina's production of both white (Irish) and sweet potatoes is found in the Coastal Plain, with Northampton County the leading producer of the white variety (796,000 bushels in 1951) and Columbus County (317,000 bushels) exceeding all others in the latter type. Rather striking improvements have been made in average yields, particularly with respect to the white variety, with increases from about 95 bushels in 1930 to a State average of 165 in 1950. In several Coastal Plain counties yields in excess of 250 bushels have been reported, with a maximum of 290 for Camden County. Acreage planted has indicated a slight downward trend for both types in recent years. This may be temporary and due in part to changes in the Federal price support program. Sweet potato vines, converted to silage, as well as the dehydrated root itself, are being used successfully as dairy feeds or supplements thereto.

FRUITS AND VEGETABLES: Due to wide fluctuations in production, data pertaining thereto are meaningless unless the many changing factors inducing these realignments are traced out in detail. Pests and marketing difficulties contributed to many recorded declines, but a big factor has been the competition of the major cash crops - mainly tobacco, peanuts and cotton. Many farmers grow truck crops only when acreages of the cash crops are restricted. This sporadic production is not conducive to the development of the requisite know-how and successful competition in this field. Although some advances have been made, many promising opportunities still exist. Better marketing facilities, including produce markets, improved fertilization, introduction of new varieties (e. g., shallots in the Wilmington area), local processing plants, better grading and packing methods are but a few avenues of approach. Some varieties of truck crops require a short growing season, permitting as many as three or four crops to be grown on the same soil in a single year. In addition to the usual fruit and green vegetable crops, such specialized cultures as floral and nursery crops, under glass and in the open, bulbs, nuts and grapes, may hold promise.

LIVESTOCK: Most authorities agree that not since the earliest colonial days, when the virgin lands of North Carolina served as a free grazing range for great herds of cattle, has the raising of stock, and other farm animals, occupied the important role of which it is capable. All the requisite elements are here and in general lend competitive advantages over other producing sections of the country: (a) the mild climate favoring year-around pasturing with minimum need for cold weather protection, (b) soils well adapted to, and productive of, large stock food surpluses; (c) an abundance of low priced pasture and woodlands, interspersed with good cropland - an ideal situation for diversification and combining with cash crops production; (d) comparative freedom from most stock diseases attained by control programs; (e) potential consumer market outlets at least equal to those served by other sections of the nation. Under normal conditions the farmer can obtain a higher net return from his crops by feeding them to his own stock rather than surrender the enhanced value of both products to others. By so doing he also eliminates some of the transportation and storage costs in bringing stock and feed together.

Various explanations have been advanced for retarded development in this promising field. Some claim that many North Carolinians prefer a marginal livelihood in other pursuits requiring less personal effort than that demanded in stock raising. This does not appear valid, at least with respect to meat production, in counter-distinction to the labor required in such pursuits as dairying. Others feel that the presumed high initial cost of obtaining a suitable herd base of blooded stock has been an effective deterrent. Again, although some capital is of course required, and high producing strains, purebred or grade, should be the aim of every livestock farmer, these are not necessarily the only animals with which to start a herd. Most farmers begin with grade females and up-breed by using purebred males. Some of the best dairy bulls in the nation are now available to the owners of family cows as well as commercial dairymen, through artificial breeding. This practice, first introduced in the State in 1948, is now used with more than 10 per cent of the dairy cows. The similar advantages of artificial breeding for beef herds have yet to be developed properly in North Carolina.

Selective breeding and constant culling based upon carefully kept production records, have resulted in rather striking improvements. The Dairy Herd Improvement Associations have assisted materially in this program as illustrated by the fact that DIHA cows averaged 8107 pounds of milk in 1950 up from 6185 lbs. in 1930 as compared with an average of 4460 lbs. for all dairy cows in the State.

Proper stock feeding is perhaps of equal importance to selective breeding, and much opportunity exists in this State for better returns on feed used. It presents many problems, but with the numerous extension, testing and other advisory services available to the farmers of the State, there is no reason why these improvements cannot be attained. Success involves, among many other things, a proper balancing of pasturage and concentrate feeding - grains and protein supplements. Two acres of improved pasture - Ladino clover, fescue or orchard grass - for each animal unit should be the ultimate goal of every farmer, according to North Carolina authorities. Again, rotation in pasture use, to prevent over grazing and maintain parasite control, is important. New feeds, and combinations

thereof, are coming into the picture: citrus and wood molasses used as enriching agents; urea and distillers' solubles; cottonseed, soybean and fish meals, particularly as hog fatteners; meat scraps and sweet potato meal; ground corn cobs with additives as roughage for winter feeding.

The multiple influences exercised by markets, processing and milling plants are too complex for treatment here. However, it might be noted that up until the past year it has been usual for North Carolina to import fluid milk to meet local needs. Expansion of hog and beef fattening programs in the State should, and probably will, be accompanied by a corresponding local increase in packing plant facilities.

The type of stock raising best adapted to a particular farm is dependent upon numerous factors, including size, topography, soil type, availability of pasture and woodland and, of course, markets. Operators with small acreages should tend toward dairying, poultry or similar intensive systems which require comparatively little land and much labor. Beef and sheep are better adapted to larger farms with adequate pasture. To obtain maximum advantage of available pasture, sheep are best suited as a secondary source of income supplementing that derived from other livestock types. In areas with grain surpluses, farmers may feed steers for market. They may be finished on grain alone, as in the midwest, or mainly on grass and then short-fed on grain for the final 60 to 90 days. Correlation with market peaks is of particular importance here. The two-litter system of hog production should be followed since it distributes labor and makes better use of buildings.

Poultry is well adapted to small farms with limited income. It can be highly profitable on the larger farms as supplementary income, particularly if the farmer can grow much of his own feed, the latter representing over one-half the total cost of production. Flock size is important. With turkeys, producers having 500 birds or less made an average profit of only 14 cents each, compared with 67 cents for those with flocks of 1000 or more. It takes almost as much time to care for a small flock of 50 laying hens as it does for 500.

One of the most neglected sources of supplementary income to farmers is that potentially possible from farm woodlands. About half of the State's total woodland is owned by farmers and about half of the total farmland is in woods. In addition to the obvious possibilities of producing limited amounts of pulpwood and timber, livestock raising can, with proper management, utilize to advantage many of these woodland acres as pasture.

FARMING TECHNIQUES: Nearly, if not all, of the improvements in the yields and quality of agricultural products, during the past few decades, have been attained through better farming practices. Some increases have been, indeed, striking, yet all authorities agree that progress made to date is but an index of those yet possible. It is impractical even to enumerate the many beneficial practices presently used by the farmer, or available to him. Some of the more important aspects of these developments pertain to:

- a. Soil management; including testing, crop adaptation, rotation and preparation, erosion control and fertilizer practices.
- b. Seed and stock breed selection; including certification, testing, record keeping and culling.
- c. Crops and tillage; including pest, disease and weed control, diversification, mechanization, grading storage and marketing.

Passing reference has been given above to a number of improved techniques as related to specific crops. Some additional comments might be in order with respect to fertilization, since it pertains to all crops and is fairly representative of the many advances which may mark a new era in North Carolina agriculture. Although the use of fertilizers in the State has doubled in the past decade, few crops, with the possible exception of cotton and tobacco, are receiving adequate fertilization necessary for the highest net financial return. Based upon improved yields only, the State Department of Agriculture has estimated that the following potentialities still exist:

POSSIBLE YIELD INCREASES WITH PROPER FERTILIZATION
(Bushels per acre except hay which is in pounds)

	<u>CORN</u>	<u>WHEAT</u>	<u>OATS</u>	<u>HAY</u>
With Present Fertilization	37	15	30	2,320
With Recommended Fertilization	64	31	68	5,540

Exceptional instances of improved production through fertilization can be cited, such as increases from 9 bushels of corn per acre for nitrogen deficient soils, to 128 bushels when this lack is supplied. Of course other factors enter, such as soil adaptability, chemical components of fertilizer used, plant spacing, leaching and other weather effects, hybrid seed use, rotation with cover crops, application techniques and liming practices. Net increase in returns, with due regard to fertilizer costs, are all important yardsticks. As an example, tests conducted by the North Carolina Experiment Station over the past few years have produced some interesting results with respect to various amounts of fertilizer, based on nitrogen content, when applied to corn crops, with requisite amounts of potash and phosphorus made available in the soils, some of the resultant data, converted to 1951 prices appear below. In addition to quantity, improvements in quality usually occurred, such as a material increase in protein content of the grain.

COMPARATIVE RETURNS FROM INCREASED FERTILIZATION

Nitrogen applied, lbs. per acre	0	40	80	120	160
Average yield, bu. per acre	26	54	74	85	91
Value of corn; \$1.67 per bu.	43.42	90.18	123.58	141.95	151.97
Cost of fertilizer per bu.	.04	.14	.19	.24	.29
Total production cost per bu.	1.71	1.00	.85	.83	.85
Net profit per acre	-1.12	36.11	60.96	71.75	74.44
Return per dollar for fertilizer	0	6.45	5.66	4.73	3.95

Over-fertilization can occur, as sometimes happens in the case of tobacco, resulting in burned root structures. However, this is usually a case of improper techniques in application rather than in the amounts applied. Ample information in this regard is readily available to every farmer, including specific recommendations based upon free tests of his particular soil. Also, the quality and chemical analyses of all commercial fertilizers are subject to State inspection; certification as to active ingredients is required of manufacturers.

As a related consideration, it might be noted here that, of nearly 2,000,000 tons of fertilizer used in the State, about 400,000 tons are manufactured in the Wilmington, N. C., area, with additional large amounts produced in other sections of the State. Therefore, any significant increase in use should be, in some degree, beneficial to home industry. There is a further possibility that this commodity may serve as a back-haul for export grain via barge to Wilmington, if and when the latter movement proves feasible (see "Markets and Storage" sub-section below).

Observations along the above lines could be presented with respect to the improvement of every phase of agriculture. Much has been done and present progress holds bright promises of things to come.

MECHANIZATION: One of the greatest opportunities for reducing production costs on North Carolina farms is through mechanization. In a 1949 study made in the Tidewater area, tractor power was more economical than mule power, for all except farms of about 33 acres or less. One tractor will handle up to 130 acres and will replace from two to six mules. Depending upon the size of the farm, type of crop and other factors, studies have indicated that mechanization can save up to one-third of the operating costs and two-thirds of the man-hours of labor, per acre, for some crops, such as soybeans. It has almost doubled the output per worker; freed for other purposes land that had been used to support workstock; improved the timing and flexibility of farm operations; and made power available for other farm tasks and equipment. For example, some progress has been made in the use of auxiliary power equipment such as milking machines, tool grinders, feed choppers, pumps, saws, etc. About 75 per cent of the farms have electricity.

Until recent years North Carolina lagged in the mechanization of its farms. Several factors have contributed to this retarded conversion. First is the matter of farm size, which in this State, averages 67 acres; however, of the 288,500 farms the average number of acres in cropland is about 27, and of these only an average of 20 acres are actually harvested.

Another factor is the relatively large amount of hand labor involved in such popular cash crops as tobacco, cotton and peanuts. Although some mechanical devices are being introduced for these crops, such as the cotton picker and the tobacco harvester, mechanization is still largely confined to land preparation. Again, during the war period, and several years subsequent thereto, equipment was difficult to procure. Also, the general increase in farm prices during recent years was a needed element in assisting farmers to finance the purchase of equipment. Another important deterrent is the high prevalence of tenant farming,

usually involving limited acreage and the provision of equipment dependent upon the owners' rather than the tenants' interests, as to relative economy. Not only does the size of farms critically influence this economy, but likewise the shape of the individual fields, the irregularity of which may make the use of other than small tractors difficult.

Beginning about 1940, and particularly since World War II, mechanization has accelerated materially. In 1940 there were only 12,800 tractors of all types in the State. By 1952 this number had increased to an estimated 93,200, or just short of an average of one tractor for every three farms. Considering the number of two-tractor farms, it is probable that not more than 25 per cent of all farms in the State have this basic equipment. In 1945 there were 4,900 combines; this number had increased to an estimated 18,000 by 1952. The number of trucks on farms also showed a substantial upward trend, from 20,600 in 1940 to an estimated 75,000 in 1952. In the same interval, 1940-52, the number of horses and mules on North Carolina farms decreased from 375,000 to 314,000.

In addition to equipment individually owned by the farmer, much use is made of custom tillage and harvesting by contract equipment operators. The heavy equipment required in land clearing usually entails contract operations. However, too much of this work is presently performed by mule, and small tractor power, supplemented by excessive amounts of hand labor. Also very few of the contract clearing operators have sufficiently powerful equipment to handle other than the smaller growths efficiently. This lack is probably due to the relatively large initial capital outlay required. A possible solution might be a State supported pilot program with a mobile demonstration unit consisting of the necessary large size dozers, rooters, winches and other auxiliary pieces. Nominal charges commensurate with costs, could be assessed during the pilot program, with the ultimate objective of encouraging private enterprise to enter the field after profit potentialities have been indicated.

Although promising trends are indicated above, the State is still considerably behind the more modernized agricultural sections of the nation, and until at least some of the obstacles to further improvement, particularly farm size and high tenancy rates are removed, it will be at a distinct economic disadvantage.

FARM TENURE: In contrast to the middle and far western portions of the United States, North Carolina is a region of small farms. In the Coastal Plain approximately 85 per cent of the farms contain less than 100 acres, and 75 per cent have less than 70. We have seen some of the disadvantages, particularly with respect to mechanization, which accrue from these restricted farm acreages. A related consideration is that of farm tenure - i. e., the effects and implications of full or part ownership, as compared to tenant operation. Some aspects of this problem have been discussed above in connection with the regional economy of the Coastal Plain. In some sections of the Tobacco-Cotton belt high percentages of tenant operated farms are found - up to 77 per cent in Edgecombe and Greene Counties as compared to a 38.3 for the State as a whole. Although the trend during recent years is toward improvement, the following data reveal a considerable margin of potential betterment:

<u>OPERATED BY</u>	<u>1930</u>	<u>1945</u>	<u>1950</u>
Full Owners	41.5	50.4	49.2
Part Owners	9.2	6.9	12.5
Tenants	49.3	42.7	38.3

Farms operated by managers are not included above. Various types of tenancy may be involved such as:

- a. Cash tenants paying a fixed sum as rent.
- b. Share-cash tenants paying a part of the rent in cash and a part as a share of the crops, or of the livestock produced.
- c. Share tenants paying a share of either the crops or livestock, or both, but no cash.
- d. Share-croppers paying only a share of the crops. These may be mere croppers whose landlords furnish all of the necessary work power - mules, tractors or both.

The cropper usually works under the close supervision of the landowner or his agent and the land assigned is often merely a part of a larger enterprise operated as a single unit. The share-cropper forms by far the largest part of the tenant operated group - about 90 per cent, and includes over 45,000 white and 40,000 colored farmers.

Many of the rental arrangements in use on North Carolina farms are virtually the same today as they were 50 years ago. They do not, in general, take cognizance of such modern developments as mechanization, improved farming techniques and the need for diversification. Much study has been given to this very real problem and among the many recommendations that have been advanced, those presented by the North Carolina Board of Farm Organizations and Agencies in their recent publication, "The Challenge," appear to be applicable to an improvement, at least in farm rental practices. These recommendations are quoted below:

- a. "Leases should provide security of tenure for both landlord and tenant. The tenant needs to be sure of employment, while the landlord must be assured of having someone to operate his farm. To provide security, leases should be for a longer term than the usual one year.
- b. "Leases should compensate tenants for improvements on the land and the landlord for property destroyed. Such compensations will promote investment in pastures, in soil conserving practices, in buildings and in livestock.
- c. "Leases should be written and should contain a plan of operation as well as arrangements for sharing the income. The best procedure usually is for the lease to specify that a plan will be prepared annually and attached to the lease.

- d. "Rented units should be larger. Larger units are better suited to mechanization and the addition of livestock. As the size of rented farms is increased, better tenants can be attracted and developed.
- e. "Tenants should own all power (workstock and tractors) and equipment. Such an arrangement promotes mechanization and permits tenants to accumulate property and leads to a greater total production plus equitable distribution of returns.
- f. "In share agreements, cash costs should be shared in the same manner that income is shared. For example, if income is shared 50-50, cash costs should be shared 50-50. Bonus or penalty provisions should be added to insure the needed input of cost items not shared.
- g. "Share agreements should include all enterprises - not just the crops. The landlord's sharing in the income from livestock should permit him to furnish needed facilities. Productive livestock should be owned in the same proportion as income is shared.
- h. "Management responsibilities should be shared to assure the quality of management necessary for a more progressive agriculture.
- i. "Leases should permit flexibility of farming operations. Preparation of an annual farm plan will provide this flexibility.
- j. "In cash rental agreements, the cash rent should be flexible to vary with prices. For example, if prices should double, the cash rent should double."

Although the above readjustments may bring needed changes in rental and share-cropping practices they will not bring about the improved economic and sociological conditions generally associated with, and largely sourcing from, the pride and self-interest of individual home ownership. Programs that look to this end are much needed in North Carolina and particularly in the Coastal Plain.

PROCESSING AND MARKETING: The degree to which the individual farmer can influence the many and complex factors which enter the overall picture of marketing is much smaller, of course, than that which he exercises over crop production. With the advent and increased use of frozen foods, pre-cooked, pre-packaged meats, better transportation and produce assembly facilities, new processing techniques and other services, the proportion of overall marketing functions performed by the farmer has correspondingly decreased, yet at the same time the marketability of his products has improved. Also, the price received for the product, relative to the cost of the marketing services performed has probably increased. Some of the remaining opportunities through which the farmer can influence the field of marketing are: an informed choice of planting and harvesting schedules to take advantage of seasonal price fluctuations; grading practices which will take maximum advantage of price differentials based upon quality standards; and better on-the-farm storage to facilitate holding products for rising markets or for direct use on the farm.

Individual membership in cooperatives and other associations may exercise mass pressures upon the price structure of specific commodities, either through induced buyer competition or reduction of marketing unit costs by increasing the volume and concentration of produce handled.

Except in the case of tobacco, the farmer plays a much less important role in processing and curing his products than formerly. Also, some of the elements of risk taking have been passed on to others. This is particularly true in the matter of price fluctuations since the advent of Federal price support and acreage control programs.

Although there have been considerable advances in recent years in both the number and type of services rendered by such facilities as produce markets, livestock auction centers, processing, packing and milling plants, market reporting and educational programs, wide fields of action yet remain to be developed.

Until recently much of the farmer's produce was used on the farm or marketed locally. If the wider and generally more profitable markets of the Atlantic seaboard are to be tapped effectively better facilities will be needed. The more important of these are: processing plants; packing plants for livestock; adequate storage - both commercial and on the farm; and more efficient transportation media at equitable cost.

North Carolina has gone much farther than most states in providing her farmers access to local markets by the very extensive farm-to-market road program initiated some years ago. Due to transportation cost inequalities, among other factors, her farmers are not in an equally advantageous position with respect to out-of-state markets. In some bulk commodities such as grain and tobacco there are possibilities for improvement in the expanded use of water transportation, particularly by the Atlantic coast network of inland waterways. This aspect will be further discussed below.

STORAGE: Lack of adequate storage is still a problem with regard to grain, even though much new capacity has been built in recent years. Two general classes of storage are involved: on-the-farm and commercial. Commodity Credit Corporation storage needs enter the picture of both classes. Provision of the first type gives the farmer more selectivity in timing both harvesting and marketing, or choice of feeding to stock on the farm. With dryer facilities available he may harvest his corn in August or September taking advantage of peak prices rather than leaving it in the field during the fall and thereby subjecting it to deterioration, rodent and insect attack.

For some 25,000,000 bushels of Coastal Plain corn and other grains that leave the farm for market, no reliable up-to-date estimates are available as to deficiencies in commercial, or in-transit storage; however, construction of this type has been accelerated during the past few years as indicated in the table below:

GROWTH OF COMMERCIAL GRAIN STORAGE CAPACITY
(Thousands of Bushels)

TYPE	1948	1954	
		STATE	COASTAL PLAIN
With dryers	0	3,935	3,465
Without dryers	3,432	3,587	455
Total	3,432	7,522	3,920

The high proportion of storage equipped with dryers in the Coastal Plain reflects the educational program, instituted in 1948, which emphasized their need. After subtracting the grain which goes to market from total production, there remain about 31 million bushels which do not leave the farms. For this volume present storage facilities are entirely inadequate.

Aside from the provision of adequate storage for North Carolina's domestic market grain consideration should also be given to the feasibility of creating an overseas export outlet through either of the State's deep-water ports. Although local grain may not be able to support such a movement alone no valid reason appears why it could not enter this field as a supplement to western grain shipments, provided freight rates from these western sources are not unduly discriminatory in favor of the present outlets through Baltimore and Norfolk. Preliminary steps have been taken recently with a view to the establishment of equitable grain rates to ports in this State. Obviously, a modern grain terminal, with appurtenant facilities, would be required at Wilmington or Morehead City. Provision should be made to receive barge shipments of grain moving from existing and future terminals located on the State's inland waterways. At the present time a considerable movement of local grain by barge to Baltimore for export has developed in spite of the long haul (350 miles or more) and frequent instances of down-grading based upon alleged condition upon arrival there.

As an aid to the financing of a deep-water terminal considerable study has been given during the past few months to the feasibility of incorporating additional storage capacity for contract rental to the Commodity Credit Corporation (C.C.C.). A five to six year rental agreement has been proposed by this agency on a guaranteed basis of from 50 to 60 per cent of a suggested storage capacity of 1,000,000 bushels. Duplicate applications were submitted to the C.C.C. just prior to the closing date last September (1953) by the Wilmington Port Commission and the State Ports Authority. Initially a February deadline was set by the C.C.C. for submission of preliminary plans. This was later extended to April. As a temporary fulfillment of this requirement schematic drawings were prepared in the hope of keeping the applications in force until certain differences of opinion among interested parties could be resolved. The present (May, 1954) status of this project is still indefinite but there appears to be the possibility of losing this C.C.C. rental storage facility.

It appears that guaranteed rentals would amount to a minimum of \$125,000 annually for one-half the total proposed storage of 1,000,000 bushels and that there is considerable assurance these rentals would materially exceed this amount.

Continued for a minimum of six years this rental could assist materially in the initial financing of this project. It should also place North Carolina in a more favorable competitive position with other eastern ports, particularly if and when world grain markets become more stabilized and currency restrictions are lessened. Further, it is claimed that the C. C. C. rented capacity would not be static storage but would likewise participate in the export movement, thus lending additional flexibility to terminal operations.

Reliable information indicates that during the next year or so there will be a critical shortage of storage facilities in all sections of the country which will meet C. C. C. minimum standards. It is to be hoped that questions with respect to location, rail-to-export freight differentials, operative responsibility - public or private, and others bearing upon the economic feasibility of this project may soon be resolved. The outcome should have a material bearing upon both the agricultural economy of the State and the development of its inland waterways.

FARM INCOME AND CREDIT: In 1952 North Carolina ranked fourth among the states (after California, Texas and Illinois) in cash receipts from the marketing of crops. Tobacco accounted for nearly one-half of the State's total. Due to the lesser importance of livestock production in this State it dropped to thirteenth place in receipts from all farm commodities. In the past ten years the relative importance of receipts from livestock sources has increased from about 15 to 22 per cent of the total, yet North Carolina ranked far down (23d in 1952) among other states in this regard.

Although the price index (1910-1914 equals 100) for North Carolina farm products has increased from 93 in 1940 to 302 in 1950, production costs, as measured by the things a farmer must buy, have gone up nearly apace.

The increase in per capita cash farm income from the sale of farm products during the 20 year interval of 1932-1952 has been even more impressive - \$61 to \$725. However, even the latter figure cannot match the 1952 national average of approximately twice that amount, nor approach that of such states as California. Increases in per capita farm income have been due, in a marked degree, to decreases in farm population as well as upward trends in prices received.

Again the picture is somewhat less favorable when the relationship between farm size and per capita income is studied. For instance, the so-called commercial type farm, averaging about 360 acres, returned more than three times the average per capita rate, and many times that of the lowest bracket of 10-to-20 acre farms. A 1945 study indicated that less than 3 per cent of the people (those living on the larger farms) received 17 per cent of the total farm income. However, these results do not take into account supplemental income of part-time farm workers, which was roughly approximated at about \$278 annually per farm operator. Undoubtedly this figure has increased materially in the past ten years.

A significant measure of public faith in the future of North Carolina agriculture is reflected in farm land prices. According to the U. S. Department of Agriculture, these prices have climbed more rapidly in North Carolina since 1940

than in any other state. In 1953 the index stood at 446 (with 1912-14 prices used as a base of 100) as compared to a national figure of 208.

During the period 1940-52, the farm mortgage debt rose about 20 per cent - from 90 to about 108 million dollars. Until about 1916 the farmer had to rely almost entirely upon private credit sources to finance his operations. The use of borrowed funds was not only limited but costly. During the next 25 or 30 years Federal loan agencies greatly increased their proportion of farm debt carried, until 1940 when such agencies were financing nearly three-fourths of the North Carolina total. After 1940 the trend reversed and by 1950 private sources were accounting for 77 per cent of the farm mortgage debt. The cost of most types of credit is still higher for farming than for commercial and industrial activities. A recent study in the Coastal Plain indicated that interest rates assessed by commercial banks are about the same as those on government loans. However, rates levied by private sources, other than commercial banks, are generally much higher.

Present indications are that North Carolina farmers are rapidly becoming aware of the many promising readjustments and improved practices available to them. These readjustments will require considerable amounts of new farm capital in addition to that needed for normal operations. Credit facilities to meet the latter seasonal demands are generally adequate, either from governmental or commercial bank sources. For example the Warehouse System, first inaugurated in 1921, by the State Legislature and administered by the State Board of Agriculture, under rules and regulations of the U. S. Warehouse Act, issues licenses for public storage and certificates attesting the grade and quantity of products stored therein. These warehouse receipts serve as collateral for loans from banks. This agency also assists (up to 50 per cent) in the financing of grain elevator construction through the medium of an operating fund (now about \$750,000) originally acquired through the 25 cent tax per bale of cotton.

To take advantage of the inviting possibilities of farm readjustments such as diversification, mechanization and larger acreage per farm, most farmers will need borrowed capital. For instance, about \$16,000 is required to establish a 20-cow dairy or a 40-head beef herd, even if the land is available. It will take in excess of an additional \$5,000 to purchase a tractor and the minimum amount of mechanical equipment. Even small farrowing houses needed for brood sows cost in excess of \$75 each and other farm buildings are relatively more expensive.

Recent studies were made of the capital outlay required for recommended readjustments on medium sized farms (about 70 acres) in the various sections of the State, and the estimated increase in net cash farm income which might be expected therefrom. In the Tidewater area the most important adjustments recommended, in addition to adoption of better farming techniques, were: increased emphasis on livestock production, particularly hogs, sheep and beef, and a shift of low, wet lands from crops to pasture. For the farms tested it was estimated that the added capital needed would be about \$7000, and that net cash income would be increased from \$1393 to \$3752 annually.

Similar results were derived for the other Coastal Plain regions. Here the adjustments recommended involved: increasing pasture by renovating native pasture; seeding idle and small amounts of the poorer cropland; conversion from two-family to one-family farms; mechanization by adding tractor and auxiliary equipment; and adding hog production on a commercial scale. It was estimated that \$5000 of additional capital would be required and that net cash farm income would be increased from \$4355 under present practices, to \$7423 under those recommended.

Any steps which will increase the availability of credit and lower the cost thereof will contribute materially to this "new look" for the agrarian economy of North Carolina. Lending agencies should be staffed to handle this rather specialized type of financing. As in the industrial field, many of the larger banks should have available the services of specialists, with a sound background in agriculture, who would advise both the lending agency and the farmer as to the feasibility of proposed readjustments. Opportunities in this aspect of farm financing are numerous and inviting.

RESEARCH AND DEVELOPMENT: The North Carolina Department of Agriculture is well organized for its assigned mission of promoting the development and improvement of agriculture in the State. It operates in close cooperation with North Carolina State College and the U. S. Department of Agriculture. Realistic educational programs are being conducted covering every phase of farming and its related problems. Numerous services are made available including the inspection of purchased materials such as feeds and fertilizers. It has promoted the use of hybrid corn, chemical weed deterrents, pest and disease control. Its Division of Markets has recently instituted a program of daily market quotations; sponsored an increase of grain storage and drying facilities; made grain inspection services available, with attendant issuance of certificates as to the quality of grains sold commercially. It has encouraged the use of better grading methods enabling produce to meet higher marketing standards and consequent better prices. It has implemented the "Nickels for Know-How" program by which a 5 cent per ton levy on commercial feeds and fertilizers helps to support agricultural research and development.

Eight test farms, scattered throughout the State, concentrate on soil problems and crop improvement. The Soil Testing Division analyzes soils for farmers, without cost, to determine crop suitability and fertilizer needs. Frequent and well presented television and radio programs cover a myriad of subjects, supplementing generous newspaper coverage, and the publication of many pamphlets and reports by both the Department and the College.

The scope of these very worthwhile programs has been limited only by budgetary considerations affecting the availability to the Department of qualified personnel. Undoubtedly the financial benefits to the State's economy resulting from these programs greatly surpass the costs thereof.

In North Carolina, there is an overall organization known as "The North Carolina Board of Farm Organizations and Agencies." It consists of the heads of State and Federal agencies and the major farm organizations as follows:

North Carolina Department of Agriculture
North Carolina Department of Conservation and Development
North Carolina Farm Bureau Federation
Farmers Home Administration
Production and Marketing Administration
Division of Vocational Teaching, N. C. Dept. of Public Instruction
North Carolina Rural Electrification Authority
Soil Conservation Service
North Carolina State Grange
North Carolina State College
Agricultural Experiment Station
Agricultural Extension Service

Representatives from the member agencies meet monthly to discuss mutual problems. It has developed a program known as "The Challenge." This group has four full-time employees working with all agencies and the rural people, together with business and professional interests to develop county and community improvement projects. It has made a tremendous contribution to the improvement of rural North Carolina. It is a living demonstration that cooperation of all interested groups and individuals can bring about great changes for the betterment of all.

Among the many publications sponsored or issued directly by this agency, that entitled "The Challenge" is outstanding. Drawing upon the experimental and educational resources of member groups it presents in easily understandable form a definitive overall program for betterment in all phases of agriculture. We have found this publication to be an invaluable aid and this report has borrowed freely from its excellent presentations and summaries.

V. FOREST PRODUCTS

INTRODUCTION: This section treats only the broader aspects of the general field of forestry. Except for such references as are needed to develop the overall pictures discussions are confined to the raw materials before their value has been enhanced by industrial processes, such as by saw mills, furniture manufacturing or paper making. Although appropriate emphasis will be given to conditions in the Coastal Plain most of the observations presented below have equal applicability to both that region and the State as a whole. The subject matter will be treated under the following general headings:

- | | |
|------------------------|-------------------------|
| 1. Economic Importance | 4. Fire Control |
| 2. Timber Resources | 5. Related Subjects |
| 3. Forest Management | 6. Development Programs |

ECONOMIC IMPORTANCE: From the earliest Colonial times, when North Carolina was one vast primeval forest, and on through later years when naval stores (tar, pitch and turpentine) and ship timbers were the most sought-after products, these forests have assumed an important role in the emerging economy of the State. In the beginning this role was, in a sense, a negative one, tending to retard the development of other pursuit, such as agriculture, until some of the land could be cleared. As in other sections of the new country a basic concept evolved which viewed these forest masses as deterrents, rather than contributors to progress. Even later, when markets began to develop, the forests were looked upon as well high inexhaustable resources, to be "mined" without thought to the future. Only in comparatively recent years, through the pioneering efforts of a few public-minded individuals, has this disastrous trend been, in some measure, checked or reversed. For many parts of America the reprieve came too late. North Carolina has been most fortunate in its timely recognition of this threat to her economy. How successfully this new viewpoint is being developed - that timber is a crop and not a "minable" resource - will be the primary consideration of that which herein follows.

At present, forests occupy over 18 million acres (about 60 per cent) of the State's total area. The Coastal Plain, with 46 per cent of the total land area, and 63 per cent forested, contains very nearly one-half of the State's total forests. The individual counties of the Coastal Plain vary considerably from a minimum of 40 per cent forested for Greene County to a maximum of 92 for Bladen.

What is, perhaps, of equal importance is that very nearly one-half of the State's total forests are owned by farmers and that one-half of all farmland of the State is in woods. In the Coastal Plain these ratios are slightly lower - 41.7 per cent of the forests are on farms and 46.6 of the farm acreage is in woodland. Again, these percentages for individual counties vary widely. Neglecting Dare County, which has a total of only 1,619 acres in its farms, the highest proportion of total forest acres on farms is found in Nash County with 93 per cent, and a minimum of about 7 per cent in Hyde. For the percentage of farm acreages in woodland, Brunswick County ranks highest with 64 as compared to only 28 per cent

in Pasquotank. (For equivalent data pertaining to all counties in the Coastal Plain and the State as a whole, see Table No. III-1).

Due to various considerations, including the fact that farmers, engaged in part-time timber cutting, are not classed as forestry workers, Bureau of the Census totals as to employment in forestry are of limited significance. For instance, the 1950 Census shows only 3,900 persons employed in the combined fields of forestry and fisheries, whereas some authorities claim there are at least twice that many workers, self-employed or otherwise, engaged in fisheries alone. Similarly, data pertaining to employment income from forestry pursuits (exclusive of lumber manufacturing and other industries based on wood products) are unavailable. Suffice it to say that a large part of the State's farm population consists of either actual or potential benefactors from the sale of woodland products.

We find somewhat firmer ground in estimating the dollar value of primary forest products, and particularly that of industrial output based directly upon timber sources. For instance, a summary issued in 1952 by the State Division of Forestry states that the 1947 total value of these primary products was \$136,918,500. However, it should be noted that of this total, nearly 51 million dollars was assigned to fuelwood, a large proportion of which is used on the producing farm.

Some of the ranking industries, and many smaller ones, developed in North Carolina, and presumably will continue there, because of the availability of its timber resources. For instance, this State leads all others in the production of wood and upholstered furniture, accounting for more than one-eighth of the national total. The latest information available as to the output in dollar value and persons employed in the three general classes of wood-using industries are listed below:

CLASS	MAR., 1954 EMPLOYMENT	1952 VALUE	1939 VALUE
Lumber	38,600	\$300,000,000	\$46,000,000
Furniture	34,400	276,000,000	59,000,000
Pulp & Paper	9,300	197,000,000	26,000,000
Total	82,300	\$773,000,000	\$129,000,000

Many related products are involved in the above general class totals such as: veneer, plywood, barrels, crates and other types of both wood and paperboard containers. It is evident that North Carolina has a vital interest in continuing the support of these dependent industries without recourse to out-of-state sources of raw materials.

Although the above increase in value, resulting from industrial enhancement are impressive, they do not overshadow those presently possible, though neglected, by a large segment of North Carolina's population - its farmers - for again, it is they who control one-half of the State's timber resources.

In 1950 the U. S. Bureau of Census reported that North Carolina farm owners received approximately \$9,875,000 as income from forest products, or very close

to an average of one dollar per acre from their woodlands. In contrast, farmers practicing good forest management were marketing timber products worth from \$3.00 to \$15.00 per acre per year from their tracts. Generally adopted, such practices would mean an income increment from the average farm (67.0 acres) of from \$134 to \$938 annually. Even partially realized the relative importance of such added farm income is indicated when compared to the 1950 per capita cash farm receipts of \$584. Also, based upon present practice, as much as 75 per cent of the products sold might consist of standing timber, involving little or no extra labor on the part of the farm owner. Much of the additional labor required in cutting fuelwood, fence posts, poles and even pulpwood could be fitted into seasonal farming demands.

TIMBER RESOURCES: North Carolina's commercial timber resources may be conveniently divided into two general groups - the softwoods and the hardwoods. By far the most important species in the first class are the various pines, comprising over 93 per cent of that group. The remainder is made up of hemlock, spruce, cedar and cypress. In 1945 (the latest state-wide estimate available) the softwoods comprised about 66 per cent of the 42.6 billion board feet of sawtimber in the State. The present day percentage would be somewhat less due to the heavier drain on the pines as compared to an indicated increase in total volume for the hardwoods. Hardwoods consist of the sweetgum, blackgum, tupelos, white and red oaks, yellow poplar and other miscellaneous species.

Of the pines the loblolly is North Carolina's most abundant and valuable species for both lumber and pulpwood production. Although it grows best in low, moist areas this tree is an excellent producer throughout most of the State. Its rate of growth is very fast and it is well adapted for regrowth on many barren and cut-over areas.

The longleaf pine was one of the most important species in the south, having few equals for structural and other building purposes. This encouraged over-cutting and other wasteful practices until today there are much fewer stands of mature trees left. Its rate of growth is slow, particularly at the younger stages, and many cut-over acres are still barren due to the fact that it does not reproduce itself prolificly.

The shortleaf and pond pines, though important commercially, are much less so than the loblolly. The cypress formerly contributed materially to the total output and particularly with respect to its dollar value. This timber is prized because of its high resistance to decay from dampness, wind and weather. It still occurs extensively in the low swampy areas of the Coastal Plain but the more accessible stands have been considerably depleted.

The hardwoods enter most fields of forest product use, including pulpwood, although in the latter case these species are usually segregated from the pines when delivered to assembly points.

Mixed growths are usual in all sections of the State. In the Coastal Plain the loblolly - hardwood combination is found almost everywhere except in the more

swampy places. Pond pine-hardwoods characteristically occupy poorly drained areas, some variations of which are known as pocosins and bays. Bottomland hardwoods grow thickly along the flooded lowlands of rivers and streams. Two out of five of the sound trees in the Coastal Plain, however, are loblolly pine. About one sound tree in five is a gum; oaks come next and then pond pine. Various other hardwoods and pine make up the rest. Slash pine, an important timber tree in other parts of the south, is not found naturally in North Carolina; scattered planted stands occur in the southeast Coastal Plain. For the State as a whole, about 50 per cent of the sawtimber volume is loblolly and shortleaf pines, with other pines making up an additional 15 per cent. Gums and oaks, in nearly equal proportions, account for about 25 per cent. Poplar, hickory, and cypress are among the remaining species. Below the sawlog sized (9 inches or larger for pine and 13 inches for hardwood, d. b. h. -diameter breast height, i. e., 4.5 feet above ground level) and over 5 inches the volume is measured in standard cords (4 ft. by 4 ft. by 8 ft.). This so-called under-sawlog-size material is dominated by hardwoods. For all sound trees above 5 inches the total volume is about evenly divided between pines and hardwoods.

North Carolina's climate and variable topography favor fast growing rates for many types of forest trees. In some species it takes twice as long to grow sawtimber in New England as it does in this State where the longer growing season and rapid growth rates permit pulpwood cuttings within 20 years or less after planting. This rate of increase, through growth and replenishment, as compared to attrition, through cutting and damage - fire or otherwise, is of primary importance to the future of North Carolina forestry and the related activities it supports.

Unfortunately up-to-date statistics for the entire State, based upon actual field surveys are generally lacking. However, such a survey was made in 1937-38 by the U. S. Forest Service in cooperation with North Carolina State agencies. In 1951 a resurvey was started but as yet the results thereof are available for only the Southern Coastal Plain (Unit No. 1) comprising 21 counties, including 3 counties (Lee, Moore and Richmond) which, for the purposes of this report, were assigned to the Piedmont Plateau. The published report (Forest Survey Release No. 41 - September 1953) covering Unit No. 1 gives comprehensive data on forest area, timber volume, growth and drain. It is believed that conditions in other parts of the Coastal Plain are sufficiently similar to be indicative of present general trends.

Another excellent source of information is Bulletin No. 53 - "Forest Resource Appraisal of North Carolina" - 1945, issued by the Department of Conservation and Development. Although based upon a sampling of 21 representative counties (5 in the Coastal Plain) the Bulletin contains some interesting summations, a few of which are cited below:

- a. The 1945 sawlog volume decreased 6 per cent since 1938; about 61 per cent was pine.
- b. The under-saw-log sizes increased about 12 per cent since 1938; about 53 per cent was pine.

- c. In the 7 year period 1937-43 the net average annual growth for material of 5 inch d. b. h. and larger was 9,310 thousand cords as compared to an annual drain of 8,552 thousand cords.
- d. Pine was over-cut as shown by an annual growth of 5,636 thousand cords against an annual drain of 5,847 thousand cords.
- e. North Carolina's forest area is about 50 per cent stocked with sawtimber and under-saw-log sizes; 28 per cent stocked with reproduction growths, and 22 per cent, or about 4 million acres, is non-stocked with timber producing species. The greatest single cause of non-stocking is lack of adequate seed source together with the obstruction by culls and worthless hardwoods. In the Coastal Plain, fire aggravates this condition.

It would appear that although drain slightly exceeded growth in the pine species, the trend is not serious, in view of the State's total resources of nearly 260,000 thousand cords of sound wood above 5 inches, d. b. h. of all classes, including culls; however, what is serious is that the young trees coming on are hardwoods nearly two to one. It might be noted that Soil Conservation experts have suggested that over 2,500,000 acres of the farm forest land in the Coastal Plain and Piedmont should be cleared, and that 50,000 acres of poor open land should be reverted to timber use.

The 1951-52 forest survey of the southern Coastal Plain, referred to above, arrived at similar conclusions as to the growth-drain relationship in that area, i. e., a 2.6 per cent annual net gain in sawtimber volume and a 2.9 per cent rise in growing stock.

FOREST MANAGEMENT: Obviously, the highly technical field of forest management is beyond the scope of this report, even to the extent of outlining recently evolved techniques and trends. The larger companies, particularly the pulp and paper industries, working extensive tracts, are usually adequately staffed with forestry specialists and follow practices based upon the long-time view. A much lesser proportion of the lumber companies can be credited with intensive management.

The small operators, including the farmer owning a few acres of woodland, comprise a promising field of opportunity for betterments. As noted above, the farmer can materially increase his income by "cropping" his woodlands through good management. He may receive additional advantages in the way of reduced soil erosion, moisture retention, and perhaps more, though restricted, grazing area. Fuel and fence posts may be home-grown.

A recent survey indicates that 71 per cent of the small owners cut their trees in such a way that the cut-over land had little or no timber values left. Only 4 per cent cut wisely, leaving their forests able to grow as well as improve.

Again a discussion of the many ways and means by which greatly increased yields may be obtained from woodland tracts is beyond the scope of this report. Farmers and other small operators have available to them State and Federal advisory services, including the direct help of trained foresters, at nominal or no cost. There is no justification for failure to adopt modern practices because of the lack of know-how, yet some of the most obvious improvements in management are neglected, such as:

- a. Thinning by selective cutting, particularly in small forests of mixed age with weak, deformed, worthless varieties, and particularly over-crowded growths. Tree diameters may increase one-third or more faster as a result of thinning; the corresponding rate of volume increase is, of course, much greater. Thinning may be for the purpose of improving the stand or merely harvesting a cash crop. In either case definite profits are involved even though in the first case they may be deferred to later years.
- b. If woodland grazing is to be used it must be carefully controlled and usually restricted to cattle and sheep. Hogs have ruined many promising tracts occupied in part by young trees.

FOREST FIRE CONTROL: It is probable that over half of the forest lands of the State have burned during the past 30 years. This is especially true in the Coastal Plain as evidenced by a 1945 field survey of 10 representative counties in that area which produced the following results during a single year (1944), and a five year (1940-44) period.

ESTIMATED PERCENTAGES OF FOREST LAND BURNED

COUNTY	1 YR. - (1944)	5 YRS. - (1940-1944)	1 YR. AV.
Beaufort	16.7	53.3	10.7
Bertie	4.1	29.3	5.9
Bladen	11.9	36.1	7.2
Currituck	3.2	13.8	2.8
Halifax	8.6	17.7	3.6
Harnett	13.9	49.1	9.8
Jones	27.6	58.0	11.7
Pender	38.3	67.0	13.4
Tyrrell	7.5	55.3	11.1
Wayne	6.0	21.1	4.2

Although the frequency and severity rates in the Coastal Plain are considerably higher than in the Piedmont or Mountain sections the total loss to North Carolina may exceed one million dollars annually. Individual fires may cause nominal or complete destruction of the standing timber. As more forest areas are brought under organized State protection, both the acreages burned over and the dollar value of the damage appear to show some improvement over the past decade, even though there are wide year-by-year fluctuations, as indicated below:

FOREST FIRE STATISTICS FOR STATE-PROTECTED AREAS

FISCAL YEARS ENDING	1949	1950	1951	1952
Acres Protected - Millions	14.5	15.0	15.3	15.6
Number of Fires	2,285	4,056	3,441	3,283
Acres Burned - Thousands	152	461	184	233
Damage - \$1000	373	1,484	656	848
Average Damage per Fire - \$	163	732	191	259

Too much significance could be given to these data unless weather conditions during individual years, as well as improved fire detection techniques, are given due consideration. As indicated, the above data apply only to the 88 counties (a lesser number prior to 1953) which have entered into a cooperative arrangement with the Division of State Forestry whereby the local units contribute from 25 to 40 per cent of the total cost of fire protection within their respective counties. Of the 12 counties that have yet to take advantage of this arrangement, only one lies within the Coastal Plain - Currituck. Over 1,350,000 acres of privately owned forest land in the State are without coordinated protection.

The principal causes of fires are brush burning, smokers, and incendiarism in that order of importance. These three together accounted for 79 per cent of all fires during fiscal 1951-52. Recent dry periods have created critical conditions in several sections of the State, particularly in the southeast. During the first two months of 1954 about 1200 fires had occurred, burning some 60,000 acres, with damages of nearly a half million dollars.

Undoubtedly prescribed fire has a legitimate place in forest management; however indiscriminate practices and irresponsible back-firing will demand better public education and perhaps stricter regulatory measures. This is an especially serious problem throughout the low-lying sections of the Coastal Plain. State forestry officials are doing excellent work in the improvement of fire-prevention programs considering budgetary limitations and the difficulty of obtaining qualified personnel.

RELATED SUBJECTS: It has been claimed by forestry specialists that insect pests and diseases caused more timber damage than that resulting from fires. These threats are in addition to such natural hazards as lightning, ice storms and floods. Among the important damaging insects are the southern pine beetle, pine sawfly, pine tip moth, and various species of wood borers. The heart rots and cankers caused, in most cases, by fungi take a considerable toll in causing cull wood, even though the tree is not killed outright. Cooperative programs, sponsored by both State and the U. S. Forest Service and designed to enlist the help of both large and small owners have produced some encouraging results. However, these programs must be on a continuing basis and need many more trained personnel than now available if they are to be really effective.

Primary responsibility for any effective program against attacks by disease and insects must be assumed by government agencies even though education and

cooperation of the owners are essential adjuncts. Research and quarantine measures must be on at least the State level. The adoption by Congress of the Forest Pest Control Act of June 5, 1947 provides a basis for Federal cooperation with both State and private agencies.

RESEARCH: In spite of substantial progress lack of knowledge is still a hindrance to the full and most profitable use of forest land and the processing of its products. Research aimed at the utilization of waste products from lumbering and milling operations is especially needed. Even after logs reach the mill, waste products are excessive. Counting discarded material in the lumbering operations, total wastage has been estimated at about 3,000,000 tons annually in North Carolina. Some of this is used for generation of steam power and relatively small amounts are beginning to be used in special products such as various types of pressed wallboard, with resin or other chemical binders. Judging from some impressive advances made in other states and foreign countries this field has a most promising future.

FOREST LAND TAXES: There has been some complaint by individuals and companies concerning the manner and rate at which taxes are levied against forest lands. They condemn the practice of treating these lands as real estate and including the value of the standing timber in determining assessments. The position taken - and it appears logical - is that the timber is a crop in the same sense that corn or tobacco are crops, and should be so taxed if and when harvested. In some counties timberland is given a higher assessed valuation than agricultural land; however, in most Coastal Plain counties the ratio is about one-third, with resultant taxes not unduly high. More uniformity in the application of taxation procedures would appear desirable which would encourage timber growing and better cropping practices.

DEVELOPMENT PROGRAMS: Two main avenues of approach are open in improving both the present and future utilization of North Carolina's forest resources. First, by varying degrees of governmental control, through legislation, implemented with greatly enlarged regulatory and inspection facilities. Second, through educational, extension, and individual assistance services. The first method has been given much study in this State. The North Carolina Forestry Council, an organization comprising representatives from practically all affected interests, both public and private, recommended in 1950, that no immediate legislative action should be taken to regulate forestry practices on private lands. However, this was qualified to the extent that, if after a period of years of concerted, large scale effort in educational and assistance programs, adequate headway is not being made, then regulatory controls should be considered on the State level.

Although the scale of the educational and assistance program has been, for various reasons, somewhat restricted, there is considerable evidence during the past few years of its increasing effectiveness. An important problem in this program involves the need for coordination among the several participating agencies. Some of these are:

1. U.S. Forest Service - (Southeastern Forest Experiment Station, and the National Forests)
2. Dept. of Conservation and Development - Division of Forestry
3. North Carolina Agricultural Extension Service
4. North Carolina State College - School of Forestry
5. Duke University - School of Forestry
6. Various County Agents and Foresters
7. North Carolina and the American Forestry Associations
8. Several Industrial Associations (Southern Pine, Pulpwood, Hardwood, etc.)

In addition to forest fire prevention measures referred to above, activities of the State Division of Forestry include: management advice and service given directly to individual owners; preparation and dissemination of educational matter; operation of tree nurseries and seedling distribution program; the administration of State Forests; and the administration of control measures to combat insect and disease outbreaks on private lands.

The advice and actual service of trained foresters are available to every small tract owner upon request and at nominal or no cost. In addition to advice on all phases of woodland management, such as selective cutting, thinning, planting, pasturing, brush burning, pruning and pest and disease control, the local forester may assist in tree marking (for subsequent cut) and the various aspects of marketing the products.

In conjunction with or supplementing the Agricultural Extension Service, public educational programs are conducted through various media, such as free distribution of pamphlets on special subjects, magazine and newspaper releases, radio and television participation, fire prevention campaigns, 4-H Club and F.F.A. contests, and public school programs.

The growing of forest tree seedlings was first started in North Carolina about 1925. At the present time the State Division of Forestry is operating three seedling nurseries - one near Clayton in Johnston County and a second near Hendersonville. A third nursery near Goldsboro will begin distribution in 1954. At Clayton and Goldsboro mostly southern pine and some cedar are grown, while at Hendersonville emphasis is on white pine and the hardwoods.

Seedlings are distributed upon application to "cooperators" at an average delivered price of about \$3.00 per thousand. Also, several of the larger pulp and paper companies have participated in the program, furnishing seedlings purchased from the State nurseries to 4-H Club and F.F.A. members and other youth organ-

izations, without charge. Distribution has increased rapidly - from about 6,500,000 seedlings during the 1948-49 planting season to an anticipated 16,500,000 furnished to over 3250 "cooperators," during the current (1953-54) period. As a measure of coverage it takes about 1000 trees, spaced 6 feet by 7 feet to replant one acre.

Considering the million or more acres in the State needing replanting, and the undoubtedly beneficial effect of making young farmers more forest-conscious, the seedling program is filling a real need. With the wider use of mechanical devices for the actual planting on favorable ground, and increased availability of stock, this program should, and is, being expanded.

In addition to nurseries the Division of Forestry operates the Bladen Lakes State Forest, comprising some 40,000 acres, as a demonstration of management on submarginal land. Authorities appear to be in agreement that even though large tracts (total of about 1,000,000 acres) in this State have been incorporated in the U. S. National Forest system, North Carolina should follow the example of other states and greatly expand her own holdings by the acquisition of suitable cut-over land which, for one reason or another, may not be attractive for replanting by private ownership. One of the objectives would be to establish demonstration units in these State Forests and at the same time put many thousands of barren acres back into production. The Coastal Plain, in particular, has many areas of variable size that seem suited to such a program.

Among the various sources of funds which support the numerous activities of the Forestry Division, Federal contributions have been of growing importance. These allocations are based to some degree upon the relative amounts of each state's own appropriation in support of various forestry programs. For the past four fiscal years North Carolina has received an average of about \$255,000. However, there appears to be some danger of these Federal funds being sharply reduced by \$45,000 to \$50,000. State Forestry officials have indicated that this would necessitate cutting the Fire Control program by about \$15,000; Nurseries-Planting by \$10,000; and the Cooperative Forest Management project (Service Foresters) by \$22,000.

In addition to Federal and other State programs North Carolina State College and Duke University are conducting a number of experimental and demonstration projects. A mere listing of these and related activities of still other agencies would be impressive; however, most authorities appear to agree that all too few of North Carolina's forest land owners are being reached, or if so, too many are failing to respond to the instruction and other valuable services available to them.

VI. FISHERIES

To a relatively small group of people living along the eastern shores of North Carolina, fishing and its associated activities, constitute not only a means of support but a chosen way of life. Although the activities of these people are, in some instances, connected with sports fishing, such as the furnishing of guides and other services, most of them may be classified under the general term of commercial fisheries. This section touches briefly upon some of the broader aspects of that industry under the following subject headings:

- | | |
|----------------------|-----------------------------|
| 1. The People | 4. Economic Factors |
| 2. The Catch | 5. Regulatory Measures |
| 3. Fishing Practices | 6. Research and Development |

THE PEOPLE: Long before the advent of European colonists, the Tidewater Indians depended greatly upon the sea and its neighboring waters for their daily food. They developed crude but effective traps and other means of augmenting their catch of both fin and shellfish. The white settlers in turn brought with them their own skills and gradually adapted them to local conditions, or as variants of native methods.

During the early days, and in fact well into the twentieth century, the relative isolation of these shores and Outer Banks tended toward a somewhat more pronounced regionalism in their people than is generally found elsewhere along Atlantic coastlines. Call it the spirit of independence, self-reliance, rugged individualism, or what you like, it is particularly apparent among the fishing folk and undoubtedly has influenced considerably the growth and character of commercial fisheries in these coastal areas. Innovations are not always readily accepted and there is some reluctance to view as an unmixed blessing any wholesale invasion by sports fishermen and other tourists, regardless of the added revenues they may bring.

Perhaps these traits may, in some degree, account for the early lack of success of at least one attempt to form a cooperative organization, the North Carolina Fisheries Association, which was established in 1911 but did not become active until 1951. Its object is to pool individual interests and to resolve problems on an industry-wide basis. It is understood that membership in this group has grown from an initial 22 to about 200 at the present time. If developed as the spokesman for several thousand fishermen, scattered over a 300-mile coastline, this association might well go far in promoting their common interests and solving the many pressing problems of this industry.

THE CATCH: In addition to the usually applied classifications of finfish and shellfish, it is desirable to make a further distinction in the former class as between edible types and the locally important menhaden, a relative of the herring, not ordinarily used as a foodfish. In all, some 35-40 types of finfish and seven of shellfish are found in North Carolina waters. Of the former, 14 varieties (alewives, bluefish, carp, catfish, croakers, flounders, king whiting, menhaden, mullet, sea trout, shad, Spanish mackerel, spot, and striped bass) constitute the

bulk of the catch; in the shellfish group only clams, crabs, oysters, and shrimp are caught in large enough quantities to be of commercial significance.

As an indication of the volume and value of the fish caught in North Carolina waters, a summary of the 1951 catch follows. Due to the various factors, wide year-to-year fluctuations are encountered.

NORTH CAROLINA FISH CATCH - 1951

	POUNDS (Thousands)	PER CENT OF TOTAL	DOLLARS (Thousands)	PER CENT OF TOTAL	¢ PER POUND
<u>FINFISH</u>					
Menhaden	104,013	65.8	979	15.4	0.9
Alewives	12,535	7.9	129	2.0	10.3
Spot	4,615	2.9	211	3.3	4.6
Mullet	4,013	2.5	393	6.2	9.8
Croaker	2,102	1.3	113	1.8	5.4
Sea trout	1,530	0.9	207	3.3	13.5
Flounders	1,479	0.9	255	4.0	17.2
Carp	1,291	0.8	39	0.6	3.0
Shad	1,245	0.8	300	4.9	24.1
King Whiting	1,122	0.7	100	1.6	8.9
Bluefish	926	0.6	105	1.6	11.3
Striped Bass	702	0.4	134	2.1	19.1
Catfish	523	0.3	51	0.8	9.8
S. Mackerel	206	0.1	32	0.5	15.5
<u>SHELLFISH</u>					
Shrimp	8,200	5.2	1,950	30.8	23.8
Crabs	7,989	5.6	237	3.7	3.0
Oysters	1,532	0.9	632	9.9	41.3
Clams	835	0.5	192	3.2	23.0
ALL OTHERS	<u>3,007</u>	<u>1.9</u>	<u>270</u>	<u>4.3</u>	<u>9.0</u>
TOTAL	157,865	100.0	6,329	100.0	4.0

MENHADEN: It was during the Civil War that this fish was observed in large quantities off North Carolina coasts, although it is recorded that the early colonists used it as food. However, it was not until about 1908, when volume increased from a fifth to one-half the total catch, that it began to occupy an important position in the State's commercial fisheries.

The menhaden is quite small, averaging about half a pound in weight and from 8 to 10 inches in length when fully grown. Though normally considered non-edible, it is of considerable importance to industry and agriculture. The entire fish serves a useful purpose; the body oil is used for paints, linoleum, and soap; the meat and bones are made into fishmeal which is used as an animal feed; the body liquid is used to manufacture a product known as "solubles," which recently has

found wide acceptance as a softener for soybean meal supplying vitamins and proteins; and finally, the roe is sometimes used as food for human consumption. It is also the only fish caught in North Carolina waters which is completely processed in the State, supporting eight plants, seven in the Beaufort-Morehead City area, and one at Southport.

In 1951 the edible finfish represented 20 per cent (32,289,000 pounds) of the total North Carolina catch, but their value was 34 per cent of the total. They are found both off-shore and in the inland waters. Bluefish, mullets, and Spanish mackerel are found off-shore, while sea trout, croakers, and spot are caught in the sounds. These fish spawn in the open ocean and then move to the inland waters. Shad, striped bass, and alewives are caught in the sounds where they also spawn. Recently croakers have also been taken off-shore in the winter. Compared to menhaden, the catches of these fish are small. Except for the flounders and croakers, they are caught only during relatively short periods of the year, which accounts materially for the seasonal nature of North Carolina's commercial fisheries.

The national foodfish catch, at least through 1940, appears to have kept pace with the population growth of the United States. On the other hand, the North Carolina catch, instead of increasing, actually dropped slightly. The trend in the catches of the principal North Carolina foodfishes is illustrated in the table below.

NORTH CAROLINA FOODFISH CATCHES

(Millions of Pounds)

	1890	1902	1908	1918	1930	1940	1951
<u>FINFISH</u>							
Alewives	16.5	11.2	10.9	14.5	9.8	8.7	12.5
Bluefish	1.3	1.0	1.3	0.3	0.8	0.4	0.9
Croaker	0.3	1.9	1.2	0.4	5.7	4.3	2.0
Flounder	0.1	0.3	0.4	0.1	0.4	0.5	1.5
King Whiting	0.04	0.1	0.8	n. a.	0.3	0.7	1.1
Mullet	3.6	6.7	5.1	1.1	2.8	2.1	4.0
Sea Trout	1.9	3.8	4.6	3.4	5.1	4.9	1.5
Shad	5.8	6.6	3.9	1.7	1.2	0.8	1.2
Spanish Mackerel	0.1	0.4	0.5	0.1	0.1	0.1	0.2
Spot	0.4	0.9	0.9	1.2	2.2	4.1	4.6
Striped Bass	0.6	1.2	0.5	0.3	0.6	0.5	0.7
<u>SHELLFISH</u>							
Crab	0.1	0.2	0.3	0.4	1.5	4.3	8.0
Oysters	4.5	5.6	4.2	1.2	2.2	0.7	1.5
Shrimp	0.1	0.1	0.4	0.9	1.3	4.2	8.2

On the basis of fishing grounds, sound fishing shows an upward trend, while off-shore fishing has either remained relatively unchanged, or has shown a decline, with the exception of the king whiting. On the basis of types of fish, two of

the shellfish, (shrimp and crab) have shown a very strong upward trend, but oysters have fallen off sharply to a third of their late 19th century level. The finfish do not present as clear a picture, except the shad, which has maintained a level since the 1910's of about a third of prior years, and the spot, which has doubled its volume since 1930 and has shown a steady upward trend since 1890. The flounder has shown a relatively steady upward trend although the volume is not large, 1.5 million pounds in 1951.

FISHING PRACTICES: There are few places, if any, in the world where a combination of fishing grounds comparable to those of North Carolina may be found. The extensive sounds, comprising some 1,800,000 acres, are separated from the open ocean by the Outer Banks which stretch in a continuous chain from the northern extremity of the State to the Cape Fear River. Numerous breaks known as inlets, the more important of which are Oregon, Hatteras, Ocracoke, Drum, the Drain (Barden), Beaufort, New River, Topsail, and Masonboro, connect the sounds with the ocean.

The principal off-shore fishing grounds extend from the Outer Banks to the edge of the continental shelf, which is considered as ending at approximately the 100-fathom (600 feet) line. East of this line the depth of the Atlantic Ocean increases rapidly. The shelf is narrowest at Cape Hatteras, about 20 miles, widening to the north and south.

Not too much is known of the migratory habits of ocean fish, but it has been fairly well established that certain species (Spanish mackerel, striped bass, mullet, and shrimp) find their preferred habitat in southern waters and do not travel much above Cape Hatteras. Other fish, such as the menhaden, migrate the full length of the North Atlantic coast and pass North Carolina on their northward and southward travels. Other species, such as the scup and sea bass, which inhabit the northern waters of the United States travel south to the vicinity of Cape Hatteras. The net result is that the fish traffic of the region around the cape is large and numerous varieties are found there.

One deterrent to more extensive fishing off the North Carolina coast is the lack of knowledge concerning the sea bottom. Detailed hydrographic mapping of these coastal waters has not been extended south of Virginia. As a result fishermen tend to confine their activities closer to shore where the bottom is better known. They prefer to avoid the uncharted areas where rough, hard bottoms, and coral patches are encountered which may cause extensive damage to nets.

The Gulf Stream approaches to within about 12 to 15 miles of Cape Hatteras, producing a variety of currents and temperature gradients in the inshore waters. Especially during the cold months, December through March, the cold water from the north and the warm water from the south meet at the cape and a temperature barrier is formed which directly influences the movements and dispersion of the various species. During the warm months of the year the temperature differences of the waters from both regions are less pronounced and the sharp line of demarcation is considerably broadened.

Two fishing grounds have developed near Cape Hatteras; one from 15-60 miles out and to the north of the cape, extending south to a point opposite Roanoke Island; the other extending from there to just south of Ocracoke Inlet, 10-30 miles out. The fishing fleet using the northern area usually bases in Virginia, while the fleets using the southern area generally work out of Beaufort-Morehead City and the fishing villages on Pamlico Sound.

With so many interconnecting channels, and several navigable inlets, giving access to the open ocean, it might appear that the fishing fleets have a wealth of choices in their passages between their home ports and the fishing grounds, either within the sounds or off-shore. Although this is true to some extent, numerous factors may enter into, or dictate that choice. A review of channel characteristics (See Appendix A) indicates that many so-called improved waterways have controlling depths sometimes considerably less than those officially authorized. Also, even the latter are in some cases fixed at 5 and 6 feet. Channels of these depths are critically close to the loaded draft of the smaller and medium sized fishing boats. They would prohibit the passage of the larger trawlers. All too frequently the shortest route will contain one or more reaches with restrictive channel depths. This may mean considerable detouring and the traverse of relatively open water within the sounds, or a much longer run to another inlet if the boats are working the off-shore waters.

Not only are there many natural and improved channels at or near a critical depth for a particular craft, but wind tides within the sounds may change these depths by as much as two or three feet. In attempts to reduce running costs as well as the danger of cargo spoilage, the boat operators are prone to take calculated risks in their choice of passage, with occasional groundings inevitable. Sometimes they do not have the privilege of exercising a choice when caught by sudden storms or the threat of bad weather. It is quite understandable that the fishermen are constantly urging the deepening of existing channels and the dredging of new cut-offs. To offset some of the restrictions interposed by shallow channels, "buy boats" have come into use. These craft pick up catches from the smaller boats working in the sounds, thus permitting the latter to spend a much greater proportion of their time in actual fishing operations.

The salinity of North Carolina sounds decreases according to their distance from the inlets; thus it is low in Currituck and Albemarle, as compared to the salinity of Croatan, Roanoke, Pamlico, Core, and Bogue. Currituck waters are almost fresh, about 5-8 parts of salts per thousand as against 35 parts per thousand for ocean water, while the section of Pamlico Sound bounded by Ocracoke and Hatteras Inlets runs from above 20 up to 30 parts per thousand. The low salinity of Currituck Sound is maintained by the tidal lock on the Intracoastal Waterway at Great Bridge, Virginia, which prevents the highly saline water of the Waterway to the north from entering the sound. Extending inland are the mouths of the rivers, the Chowan, Roanoke, Tar, Neuse, etc., which feed into the sounds. There the salinity of the water decreases rapidly until it becomes completely fresh. These are the spawning grounds of the anadromous (fresh-water spawning) fish that visit North Carolina waters, including shad, striped bass, and alewives (also known as river herring). River pollution has had an adverse effect on all three

species. This condition, and the increase in silt in river bottoms, has had serious effects on the shad population. The catch in the late 19th century amounted to 6-8 million pounds; it has decreased steadily since then and now amounts to only one million pounds.

ECONOMIC FACTORS: The menhaden and foodfish fisheries display almost diametrically opposed economic characteristics. The former has taken advantage of modern industrial practices while the latter has perhaps suffered from its inability or reluctance to adopt modern methods.

The menhaden fishery deals in large volumes, on the average about 125 million pounds per year. The catch is disposed of in a concentrated area at Morehead City-Beaufort, with seven processing plants; a single plant is located at Southport. The entire conversion of the fish into saleable products is accomplished at these factories. The State's economy therefore benefits from all the steps involved in the conversion of the raw material into finished products. The low value of the raw material - one cent per pound at present - dictates mass production methods of handling and North Carolina fishermen have adopted them. The products into which the fish is converted; oil, fishmeal, and "solubles," do not require elaborate storage facilities with the related large capital requirements. Investments in the menhaden industry consist of factories, boats, and nets. In 1950, the values of these items were \$4,000,000, \$2,000,000, and \$180,000 respectively, or a total of \$6,180,000.

Foodfish are characterized by a relatively high price to the fisherman, around 10¢ per pound. Possibly, because of this attractive price and the fact that small boats can be used, many North Carolina fishermen are engaged in this type of fishery. The catch is disposed of at a large number of points; some 50 towns are listed as receiving points for the 1953 catch. Of these points, Atlantic, Colerain, Beaufort-Morehead City, Oriental, and Vandemere accounted for about 20,000,000 pounds, or about 40% of the catch in 1953. The remaining 60% was received by some 46 towns. To handle the catch at the towns there are some 180 dealers, with an average of about 280,000 pounds annually per dealer. In terms of fish volume, these amounts are small and are deterrents to modern mass handling methods, which require large volumes to justify the high capital investment costs involved in processing foodfish.

Until either the catch increases greatly, or concentration points for processing and forwarding of fishery products are established in North Carolina, little change in the present economic picture can be expected. Cooperative organizations, perhaps allied with or based upon the North Carolina Fishermen's Association might be able to set up, or encourage the establishment of centralized processing and concentration points and thus capture some of the profits now gleaned by firms in other states. It is possible that an arrangement could be worked out for a combination fish processing plant and truck crop terminal warehouse at some point such as Raleigh which would place North Carolina food products on the north-south food collection and distribution chain, extending from the industrial north-east to Florida.

As has been noted above, the menhaden industry is complete within the State, in so far as the catch in its waters is concerned. Huge volumes are caught; this and their low value per pound precludes the possibility of storing them before processing. Consequently processing plants must be established near the fishing grounds and only the finished products, which are not perishable, are stored before disposal to the consumer. Foodfish, on the other hand, are often retailed without conversion (except possibly packaging) from the perishable as-caught stage to some more stable form. When ice became available in large quantities many years ago, it was used to delay deterioration and this method is still the standard procedure today. With shellfish, various degrees of processing are employed before disposition.

In recent years, freezing and packaging of finfish, usually as fillets, and of whole shellfish, has become the preferred method of presenting the product to the consumer. This preparation, however, requires elaborate equipment, which is justified only if large volumes are handled. The relatively small size of the North Carolina foodfish catch, combined with the fact that receiving ports are widely scattered, and that until recent years, land transportation facilities have been inadequate, has made the establishment of large and expensive plants impractical. Improvement in the highway system has removed one of the obstacles, but the others still remain. The effect of these factors has been to keep the disposition of the foodfish catch in the iced-barrel or box stage. Each dealer-producer or dealer-distributor disposes of the fish he has acquired from fishermen by selling to truckers at his establishment, or by shipping to wholesalers in the western part of the State and neighboring states, or by shipping to northern metropolitan areas. Up to the present time this system apparently has proved to be economically possible, but competition may force material changes upon the industry. The system has created a situation whereby North Carolina foodfish are not identified as such. They are sold to processors who in turn market them under their own trade names, and often advertise them as products of another state.

It is often contended that a large portion of the North Carolina foodfish catch is sold to the Fulton Fish Market in New York City. The excellent and comprehensive treatise, "Survey of Marine Fisheries of North Carolina," contains a summary of receipts of fish at that market for the year 1945. Based on the North Carolina foodfish production for that year, less than five per cent of the State's catch was received at this New York market. The survey concludes that the chief outlets for North Carolina foodfish are the inland markets. Since similar analyses for later years are not available, it is not possible to determine whether this pattern is still valid.

To capture for North Carolina a larger share of the dollars involved in supplying the ultimate consumers of foodfish, it will be necessary either to establish large scale processing plants in the State, or contract with established plants outside the State to process the raw material and then identify the product as originating in North Carolina. To create a demand for the product, so identified, would require an expensive national advertising campaign. Much detailed analysis will be necessary before a definite answer to these questions can be obtained.

REGULATORY MEASURES: The primary purpose of commercial fishery regulation is, of course, to conserve and, if possible, increase the supply of fish in North Carolina waters. The jurisdiction of the State extends three nautical miles into the Atlantic Ocean from the coast line. Beyond this limit fishing is unregulated as there are no international fishing grounds off the coast of North Carolina.

Regulations are enforced by the Commercial Fisheries Division of the North Carolina Department of Conservation and Development, after being established by the departmental Board on recommendations of its Commercial Fisheries Committee, after public hearings have been held at which interested parties have had an opportunity to present their views. The present tendency is toward liberalization of regulations and stricter enforcement. A simplification of the regulations is under consideration. After many years of qualifying additions they have become cumbersome and contain a number of duplications and some contradictions.

To conserve the supply of fish, restrictions have been placed on the size of nets to be used; channels in inlets have been established to permit fish to migrate without undue risk; limitations have been placed on the distance from shore to which nets can be placed in the sounds; and open and closed seasons have been established for the various species. As an example of the liberalization of regulations, the ban on night trawling for brown-spotted shrimp in the sounds has been lifted to the extent of establishing a limited open season, since this particular species can be taken in quantity only after dark.

To perpetuate the supply of oysters, oyster houses are required to turn over half of the shells resulting from shucking. These are then planted in public beds on the theory that thereby a number of spats equal to those removed will find suitable surfaces on which to anchor, rather than being swept away by tidal or other currents.

With the large increase in shrimp trawling in the sounds in recent years, a dispute has arisen between oyster men and shrimpers in which the former claim that the oyster beds are being harmed seriously because of the dragging of trawl nets over them. It is claimed that this results in covering the oysters with sand which kills them. This problem is being studied by the Commercial Fisheries Division with a view to a determination of the merits of the complaint and the promulgation of regulations to alleviate the condition, if the protest is found to have justification.

This spring (1954) a regulation was adopted to improve the competitive position of North Carolina shrimpers with respect to those from out-of-state. The regulation requires that shrimpers, whose home states extend reciprocal privileges to North Carolina shrimpers, be required to pay a license fee equivalent to that assessed against North Carolina operators, and that the catch be landed at a port within the State. Those from states which do not extend reciprocal privileges to North Carolina licensed shrimpers are prohibited from fishing in waters under the jurisdiction of this State. To enforce the regulations, the Division of Commercial Fisheries uses nine patrol boats, four of which were acquired in 1954.

The enforcement personnel numbers 15 men; however, it is obvious that complete coverage cannot be obtained with this limited force and that as a result extensive violations must be common.

Considerable thought and effort have been given to the perpetuation of existing oyster beds and the establishment of new colonies. Areas are closed or opened by the State authorities, according to conditions existing in the beds. With respect to legal status there are three types of oyster beds in North Carolina: (1) Public, which are open to anyone, (2) Leased, which are reserved for the lessee, and (3) Private, which belong to the owner.

All natural beds are reserved for exploitation by the public. They are cultivated and maintained by the State. Leases are granted on areas which are not natural beds, to any citizen of North Carolina, or to any firm or corporation organized under the laws of the State and doing business within its boundaries. Acreage is limited to a maximum of 50 acres, except in the open waters of Pamlico Sound (more than two miles from shore) where the maximum is 200 acres. The leases are granted for periods of 20 years, renewable thereafter for 10 year periods. No limit is placed on the number of renewals, provided the lessee has paid the yearly rental. Private beds are owned in perpetuity on the basis of grants issued by the State prior to 1900, and no such grants have been obtainable since that time. The dredging of public beds is restricted by law to certain periods of the year, but there is no restriction on the dredging of leased or private beds.

It is of interest to note the legal restrictions imposed by neighboring states on leasing of oyster beds. In Virginia the planting law permits companies and other corporate agencies to control, through leases with the State, up to 2000 acres. On the other hand Maryland has restrictive planting laws which approach those of North Carolina with respect to acreages which can be leased by an individual, partnership, or corporate entity.

It appears that the Virginia arrangement would tend to encourage private-enterprise ventures on a large scale where a single concern could establish and direct the necessary facilities from bed development to marketing. On this basis operations approach the organizational techniques of other modern industries where control is exercised from raw material sources to the finished product. Although North Carolina acreage limitations may desirably promote small-scale operations by individuals, they do not encourage the establishment of expensive processing or canning plants unless these can be assured a continuing and dependable source of supply and reap direct benefits from long-term development progress.

RESEARCH AND DEVELOPMENT: Three organizations at present are engaged in conducting research on North Carolina commercial fisheries: (1) the Institute of Fisheries Research of the University of North Carolina, which works very closely with the Commercial Fisheries Division of the State Department of Conservation and Development, (2) the Duke University Marine Laboratory, specializing in biological research and (3) the U.S. Fisheries Laboratory. These organizations are located in the Morehead City-Beaufort area, thus simplifying consultation and the coordination of programs from this focal point of commercial fishing.

The need for extensive, continuous, and coordinated fisheries research has long been recognized, but due to the high cost and the slow progress inherent in such activities only the outlines of many of the problems have been sketched and these usually indicate that further research must be conducted before definitive conclusions can be reached.

The Institute of Fisheries Research conducts continuing biological studies, particularly of shellfish, and cooperates with the State Department of Conservation and Development in the latter's regulatory work. For this work, the Institute has recently acquired a boat built to its specifications, specially designed to be used in scientific studies of both the sounds and off-shore waters of North Carolina. It has also published a study, "Shrimp Survey of North Carolina" and contributed to the comprehensive "Survey of Marine Fisheries of North Carolina." Both surveys were partly financed by private funds and probably would not have been possible without such assistance.

The shrimp survey had as its primary objective a search for shrimping grounds in the off-shore waters, but in addition, much valuable information was obtained on water temperatures, salinities and related subjects. Of special immediate practical value to North Carolina off-shore fishermen, was a partial charting of the ocean bottom of the Continental Shelf south of Cape Hatteras. The survey did not discover any sizeable shrimp grounds in these waters, but indicated that further research would be necessary for conclusive results. The other survey has assisted materially in the formulation of policy by the Department of Conservation and Development, relative to North Carolina commercial fisheries.

In February 1954, the Institute was placed in charge of a two-year study of the marketing of North Carolina fish. The survey is being made in cooperation with the Department of Business Administration of the University of North Carolina under contract with the Department of Conservation and Development.

The Duke Marine Laboratory specializes in biological research. Among many bulletins, it has published one on seaweeds in North Carolina. These were harvested commercially during and just after World War II, but operations have since been abandoned.

The U. S. Fisheries Laboratory also conducts biological research and has assisted in the program for the replenishment of oyster beds. This is part of a nation-wide program of research affecting the fisheries of the United States, a continuing activity under the U. S. Department of the Interior.

The legislatures of North Carolina, Virginia, and Maryland appointed a committee of fisheries experts in 1953 to recommend a joint research program with the object of studying the declining finfish population. The findings of the group were that a continuing program be instituted and that it be a coordinated effort of the three states and that the budget for the first year be \$122,074 prorated among the states on the basis of their finfish catches, resulting in a contribution of \$25,350 from North Carolina.

Another example of increasing interest in the value of well-financed research programs is the bill now before the U. S. Congress which would set aside 30 per cent of the gross receipts from import duties on fishery products for nation-wide research by the U. S. Department of the Interior. If passed, about \$3 - 4,000,000 a year, based on current import duties, would become available. Such an amount would go a long way toward adequately financing studies of some of the vexing problems with which the industry is faced.

Aside from the organizations mentioned above, there are numerous others, regional and nation-wide. It is not known to what extent these groups cooperate in their activities, but based on observations of the North Carolina industry it appears almost a truism that effective cooperation is of vital importance to the success of these programs.



MOREHEAD CITY

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VII. INDUSTRY

With North Carolina filling a major role in one of history's most spectacular eras of industrial expansion and realignment it is difficult, even for those who are participants in the shifting scene, to retain a sufficiently detached viewpoint, from which to evaluate the causes and probable implications of these changing patterns. The scope of this survey permits of only a brief outline of some of the salient features, together with an attempt to distinguish such trends as may have particular reference to the economy of the Coastal Plain. The picture is changing so rapidly that even an inventory of existing conditions in Eastern North Carolina alone would not be of sufficient import to warrant its inclusion in this report.

One need not look beyond the daily newspapers and a few trade publications to be impressed with the magnitude and importance of the rapidly expanding development of industry in the South. An added index of the nation-wide impact of this phenomenal growth might be found in the sometimes rather alarmist reactions in other sections of the country where the fear is frequently expressed that industrial migration to the South may develop to such proportions as to be disastrous to established economies in these older manufacturing centers.

An important question arises, namely, whether this rapid growth is a passing manifestation caused by temporary factors and imbalances or only the beginning of a long upward trend based upon favorable conditions which give promise of persisting.

CLIMATIC ADVANTAGES: In support of the probable continuation of this industrial trend are those conditioning influences which in themselves have some degree of permanency. One such, of course, is the favorable weather. Although not too important to indoor workers, it does have secondary effects such as promotion of health, reducing lost time and permitting longer distance commuting by workers using automobiles. Certain operating costs, such as plant heating, are reduced and some processes can be carried on in the open to advantage. However, of far greater importance is the influence weather has upon the growth of those products of farm and forest which form the raw material base for many of North Carolina's industries. For instance, pulpwood, with growth rates here of from two to four times faster than in far northern climates, can be treated as a harvested crop rather than a mined resource and should therefore continue to support paper, plastics and other industries indefinitely.

RAW MATERIALS: Very few industries can afford to neglect consideration of the adequacy and geographical location of their raw material sources. Fortunately the South, and particularly North Carolina, produces the basic commodities in great abundance which form the bases of its principal industries - tobacco, forest products, cotton and other contributions from the soil. With rising transportation costs the bringing together of these raw materials is often a more critical factor than the cost of distributing the finished products. Present production rates of the above basic commodities can be, with proper management, continued indefinitely or even considerably increased, without endangering the State's natural resources of soil and forests.

LABOR: Perhaps the most important of present influences is the availability of labor. Each new factory absorbs some of that surplus; on the other hand, large segments of the material increase in the population need not be lost by emigration, as in the past, if given adequate opportunities at home. Also, the rapid trend toward mechanization of agriculture has a greater margin to fill in the South than in other regions. It would appear therefore that this labor-availability factor will continue to be operative for perhaps another generation.

Labor productivity is perhaps of almost equal importance as labor availability. There seems to be complete agreement among industrialists that the southern worker will consistently out-produce his northern counter-part. This margin appears to have little, or no relationship to relative pay scales in the two regions. Although southern wages statistically average up to 30 per cent lower than at some northern centers, instances are found where there are little or no differences in wage scales. It might be noted that the use of an average or median wage statistic can be very misleading when applied as an overall yardstick in comparing different regions, or even different industries in the same region. The proportion of unskilled to skilled labor must be carefully considered. For instance, the chemical and pulpwood industries use relatively twice as many of the skilled class than found in the cotton mill. With textile workers making up more than 50 per cent of total manufacturing employment the lower unskilled pay scales have a preponderant effect upon per capita values. Unionization has, of course, influenced the disparity in some trades. Authorities seem to be more or less in agreement that the present low percentage of unionization in the South will increase gradually but will not overtake the higher prevalence now found, and tending to increase, in the north and central states. These forecasts have taken into account the somewhat different racial background of the southern worker. With native-born populations approaching the 100 per cent mark in North Carolina and, in general, characterized by a well developed sense of independence, stability and self-reliance, it appears that the above observations as to individual productivity and unionization will remain valid for an indefinite period in the future.

A related labor characteristic is that of adaptability and the aptitude of unskilled workers to qualify for the more highly technical occupations. Again, the average southern worker has proven his capability in this respect to be equal, if not superior to those of other sections. It is true that about 25 per cent of North Carolina's population are negroes, with an equivalent proportion of the labor force. Contrary to once held opinions, they have developed rapidly in technical dexterity that has easily fitted them into industrial patterns.

WATER SUPPLY: Among the State's natural resources too much stress cannot be given to the importance of industrial and domestic water supply. Modern industry requires vast quantities, particularly in some of the chemical processes where purity is often a requisite. Although North Carolina, like other states, has not been too foresighted in avoiding practices leading to pollution of its surface flows, underground supplies constitute an almost inexhaustable reserve in many parts of the State, and particularly the Coastal Plain. With a better realization of the critical importance of water, measures are gradually coming into use which should assure the continued availability of this vital commodity. With proper management this factor can be classed as one of permanent advantage.

INDUSTRIAL SITES: An important feature of recent industrial expansions might be termed the "new look." This concerns the planned dispersion of physical plant. Corporate management, being able to observe the advantages, as well as the penalties involved, has often chosen to place new factories in smaller towns or even relatively isolated locations. It appears that this practice of bringing the factory to the suburban and even the rural worker, has set a new pattern, which will make for better living standards as well as more attractive communities. North Carolina's advantage in this respect should continue for sometime since it arises, of course, from unlimited space availability and the fact that an option exists in the location of new plants, whereas those presently situated in areas congested to the point of hampering operations, might find the cost of moving and other items of write-off entirely prohibitive. The original capital investment for plant construction is, for most simple types of structures, about one-half that current in the North (for instance \$3.00 - \$3.75 per square foot as compared to equivalent costs of about \$7.50 in Pennsylvania). This differential will probably narrow but some margin should continue indefinitely.

Not only do new facilities have the temporary advantage of careful site planning, giving due cognizance to labor availability, transportation facilities and rates, raw material and water supply sources, community services and tax structures, but the plants themselves and their installed equipment are usually new with advantage being taken of the most modern manufacturing and material-handling techniques.

MARKETS: As compared to some of the other southern and western states North Carolina, has, perhaps, an advantage with respect to accessibility of markets. Not only is it nearer than others to the great northern and northeastern population centers, but the State itself, with over four million people, ranking tenth in the country, constitutes a self-contained market which is at present far from being fully exploited. If and when this is done the present marginal advantage as to geographical position will be greatly enhanced. On the other hand, the close proximity of northern industrial complexes may operate, in some instances, as a handicap, since it tends to facilitate the movement of North Carolina's raw materials to neighboring states for processing with most of the proceeds from the product's enhanced value going elsewhere.

The advantageous factors discussed above have variable degree of permanency, but it is believed that enough of them will continue to operate over the next one or two decades to insure considerably higher than the national rate of industrial growth in the South, and North Carolina in particular.

FUEL AND POWER: To offset the above advantages this State is subject to some inherent handicaps with respect to industrial development. A principal deficiency is fuel - oil, gas and coal. A number of prospecting wells, (some in the Coastal Plain) have been drilled but as yet no oil has been found. The only large coal deposit in the State centers around Lee County where some 80 million tons are in place. This deposit has been worked spasmodically for many years but the coal's high volatility reduces its value as a domestic fuel. This should not impair its use for steam production; however, due to various factors, including vein dis-

position, thickness and partings which impose high removal cost and danger of explosions due to high volatility, this deposit has not been mined extensively. Outside of some hydroelectric energy sources in the western part of the State and in the upper Roanoke area, North Carolina has to meet her power and fuel needs by importations in the form of coal, oil, piped natural gas, and transmitted electric power.

Although some power rates have been increased recently in Eastern North Carolina, energy costs are not high enough to make this factor one which imposes a handicap on local industry when compared with the North Atlantic region. In western North Carolina and in the Tennessee Valley power costs to a moderate-sized industry may be less than one-half that paid by a similar plant in New England.

TRANSPORTATION: Some handicaps do exist with respect to transportation costs, particularly those rates applicable to certain finished products. The higher class rates for equivalent hauls in the "Southern Territory" are consistently higher than those of the "Official Territory" which begins just north of the Virginia State line.

DIVERSIFICATION: Until recent expansion and diversification interposed, some danger existed in the emphasis found on two or three major industries. For instance, in North Carolina, textiles, tobacco manufacture and wood working so dominate the picture that any drastic upset in any one of these fields might have serious repercussions in the economy of the whole State. Some fears were expressed when synthetic fibres were developing rapidly; however, North Carolina adopted the newcomer as her own with most pleasant results and without noticeable adverse effects upon her cotton milling industry. It is difficult to foresee how any revolutionary event, such as might result from the development of other new products, could seriously undermine these three, more or less basic industries. Of course, the possible overall impact of a general business depression could not be hedged against by diversification, although its debilitating effects might be, in some measure, reduced.

Although some degree of over-specialization still exists in the industrial pattern of the State, this condition is being very rapidly altered with the promise that within a very few years the variety of North Carolina's manufacturing plants will compare favorably with any other region. What risks may be involved in having a single class of raw material, such as cotton or forest products, form the broad base for an industry, can be largely counterbalanced by secondary diversifications within that industry. In the case of forestry, within its three or four dependent major divisions of lumber, furniture making, and those activities based upon the cellulose content of wood, such as paper, plastics and synthetic fibres, there are literally hundreds of sub-industries that have, or are being developed in the State. And finally, what is most important, North Carolina, by processing her own plentiful raw materials, is retaining the payrolls which have given those materials their greatly enhanced value as finished products.

INDUSTRIAL MIGRATIONS: Considerable controversy has arisen in recent years over what has been termed southern "raids" on northern industry. In fact serious proposals have been made with the view to slowing this trend by passing Federal legislation pertaining to such fields as: tax exemptions on municipal bonds used to furnish factory sites and plants; advantageous power rates from Federal hydroelectric developments; unionization, minimum wage, and other labor policies; social security provisions; amortization and tax write-off privileges; and revision of transportation rate structures. (See Article by Senator John F. Kennedy of Massachusetts in January, 1954 issue of THE ATLANTIC).

In the first place the percentage of all new industry being developed in the South, and North Carolina in particular, that has resulted from the actual transfer there of northern manufacturing facilities, is very small indeed. Although no reliable data is available it appears that a similar conclusion is in order with respect to the number of new North Carolina industries which have been provided with factories, or other facilities, financed by the sale of tax-exempt public bond issues. In fact there is no existing legal basis for such practices on the State level, and tax-exempt bonds of lower political echelons would be worthless unless their issuance was authorized by the State Legislature. In support of the above an official of the Seaboard Air Line Railroad recently made statements (before the Harvard University Conference on Careers at Cambridge, Mass., Feb. 17, 1954) to the following effect:

"I am sure it is safe to say that for every dollar spent in the establishment of industry in the South which was removed from some other area, there have been ten dollars invested in new enterprises having nothing to do with the removal of industry from any other section.

* * *

"Let me simply state here in that connection that, of the 1,100 industries which have located on the Seaboard Air Line Railroad during the past ten years, I do not know of a single one which was financed by the issuance of such bonds."

It would appear that the South, and in particular North Carolina, are fully aware of some of the inherent dangers to economic stability, and the provision of adequate public services, which could result from luring industries by an over-emphasis upon tax exemptions and cheap labor inducements. Although some southern states have statutes offering these tax exemptions to new industries, North Carolina, Georgia, Texas and Virginia do not, the latter state having repealed its law permitting this practice, in 1946.

TAXES AND CREDIT STRUCTURES: The State government has been operating for a number of years on an essentially balanced budget with frequent surpluses in the General Fund. Although earnings will fall below estimates by less than one per cent of a total of about \$186,000,000 in fiscal 1954, there was an ample carry-over from 1953 to offset this. Aside from the old General Fund and Highway Fund debts, where adequate provision has already been made through sinking funds for their retirement at maturity, the only outstanding State obliga-

tions are the new Highway Fund debt of \$177,000,000 and the General Fund Bonds for schools, ports and institutions, sold since November 1, 1950. The Highway Fund issue is adequately provided for through a one cent gasoline tax (of the 7 cent-plus, total) irrevocably pledged to its retirement.

Without, in any way, stinting public services, and in some fields, such as secondary highways and the educational system, furnishing outstanding examples to other states, North Carolina has set an enviable record in that there have been no increases in the State's tax structure since 1933. Some equally impressive records have been made by counties, municipalities and other subordinate political units under the guidance of the Local Government Commission. Also, North Carolina's Employment tax rate is among the lowest in the Nation, the average employer assessment being about 1.2 per cent.

Perhaps the underlying policy of the legislative and administrative functions in the State could be described as conservative-progressive. Each year finds an unusually high percentage of successful businessmen giving their time and experience as members of the State Legislature, and the result that industry has found here those elements of stability which are so vital even to the most imaginative and enterprising management. Since these factors are based, in some degree, upon the innate characteristics of the people they should continue indefinitely.

There are ample reserves of capital within the State to furnish the credit base for present and prospective industrial expansion and these resources are growing rapidly. To supplement financing services performed by banks and their correspondent institutions, over 100 community development corporations have been, or are being organized throughout the State, usually as adjuncts to local Chambers of Commerce.

INDUSTRIAL PROSPECTS IN COASTAL PLAIN: The above discussions as to the relative permanency of current industrial advantages accruing to North Carolina, in general not only have equal application to the Coastal Plain but are, in some instances accentuated there. The Coastal Plain has a somewhat milder climate, favorable reserves of industrial water supply, a higher percentage of labor availability, with a better future potential of diversion through farm mechanization, and greater concentrations of raw material production from forest and field which support the major industries. With 90 per cent of cellulose requirements for various manufacturing processes, such as rayon, paper, plastics, etc., coming from timber sources, the Coastal Plain's extensive forests - assuming proper management - can support a very material expansion in these industrial fields.

At the present time vast quantities of both pulpwood and ground pulp are shipped out of the State for final processing. In fact the improvement of inland waterways has encouraged, through lower transportation costs, this diversion of raw material to other states, even though it did promote a material increase in the sale of woodland products.

Similar considerations apply to the Coastal Plain's agricultural production. This could form the base of innumerable processing industries in addition to those

directly supported by tobacco and cotton. Soybeans give promise of further multiplying the many uses already assigned to this versatile plant. Only a start has been made on production of stock feeds, using a great variety of farm and fishery products, from grains to menhaden by-products. It would require pages to outline even the more promising opportunities in this field.

The Coastal Plain, like the rest of the State, must import most of its fuel requirements, either as such in the form of oil and coal, or as transmitted electric energy. But again, this region has the advantage of imports through its deep-water ports and a means of efficient shallow-draft distribution over its many miles of inland waterways. This probably more than balances western North Carolina's shorter transmitting distance from TVA power plants. There is no impending threat of a power shortage in the coastal areas, particularly since the construction of a large 300,000 horsepower (150,000 H. P. completed) steam generating plant at Wilmington.

Even though their potentialities are far from being fully developed, Eastern North Carolina's deep-water and shallow-draft waterways will give it a definite competitive edge over interior regions as industrial patterns emerge and grow. This conclusion has been reached by every analyst who has studied the problems of that region; an instance of which is referred to below.

WILMINGTON STEEL MILL POSSIBILITIES: In 1951 the Department of Conservation and Development retained the services of William G. Friedrich, a consulting economist and engineer, to study and report upon the economic feasibility of an integrated steel mill in North Carolina and more specifically at or near Wilmington. The then existing Korean War effort and the impending repetition of World War II steel shortages appear to have been given particular consideration in the resulting report and its recommendations. Although the latter were unfavorable to an immediate promotional campaign, or a detailed engineering study, the door was not closed to the possibility of future industrial steel demands in the area giving definitely favorable promise to such a venture.

COASTAL PLAIN TRENDS: Although some deterrent factors to Coastal Plain industrial expansion may have been overlooked, or unduly minimized in the above discussions, such as the lack of local market concentrations, the conclusion would appear inescapable that this region, with its many advantages equal or superior to other parts of the State and South, should participate fully in these progressive developments.

In fact Eastern North Carolina need not be ashamed of its efforts and their currently expanding results in this field. During the past five years over 100 representative concerns, including 15 major industries have chosen one of the 41 Coastal Plain counties for their operations. These industries represent capital investments of over \$112,000,000 and added employment for some 11,000 people. An excellent degree of diversification is shown in the numerous types of new enterprises. Also many of them utilize the raw materials found so plentiful in that area. Advantage is being taken of the region's large reserves of highly adaptable labor through such technical processes as offered in the rapidly expanding elec-

tronics field. One could be almost tempted to the passive attitude of assuming that this march of progress is self-motivating and will continue unabated without further impetus given through local initiative. This could be dangerous.

THE SPIRIT OF ENTERPRISE: There appears to be no dearth of resources, both human and natural, plus the necessary capital, to make possible a continuation of industrial expansion in all sections of North Carolina. There is a third, and possibly the most important ingredient for success and that is business enterprise. Without leaders with imagination and the will to venture these fruitful fields of opportunity will lie fallow. Surely the initiative so impressively shown by North Carolina's industrial pioneers, most of them native sons, has been passed on to the present generation. They gave to this State national leadership in the several fields of tobacco, textiles and furniture, and retained that preeminence during critical readjustments and the impact of changing patterns and techniques. In the tobacco industry they evolved methods of financing, manufacturing and marketing which taught new approaches to the biggest industries of the Nation and revolutionized the selling of mass consumer goods.

It would be indeed difficult to envision why, short of catastrophic world events, the present very favorable trend of industrial development in all sections of North Carolina should not continue indefinitely.

VIII. TOURIST TRADE AND RECREATION

In the presentation of facts and figures pertaining to this broad field it will be necessary to confine discussions to those aspects which have a fairly direct bearing upon the present and future economic status of the Coastal Plain. Adopting this strictly Coastal Plain viewpoint it will be unnecessary to cite the many attractions, public park facilities, and statistics pertaining thereto, as found in other sections of the State.

In so far as the tourist trade is concerned, the inviting playgrounds and scenic attractions of the area are treated from a rather materialistic viewpoint, with emphasis on the extent to which they may enrich, rather than amuse and entertain, the present populations of Eastern North Carolina. The term "Eastern" is used advisedly since, to some extent, that region must "sell" its tourist attractions in competition, not only with other states, but with the Mountain and Piedmont sections as well. Not that this intrastate competition is undesirable any more than that involved in the promotion of industrial development. With many public services supported by the same tax structures, any improvements in the economic health of one section, must in some measure, accrue to the benefit of the State as a whole.

As to recreational and aesthetic values, these not only serve to lure the transient vacationer from out-of-state and other sections of North Carolina, but are inducements to ultimate residency of the casual tourist. Also, assuming adequate means of livelihood in other pursuits, pleasant surroundings and diversionary opportunities act as deterrents to present emigration trends of the native population and lend permanency to the residency of the newcomer.

Although appropriate reference to publicly supported recreational facilities in the Coastal Plain will be made, it would appear that these are but details in the overall picture of what has, and what can be done to more fully capitalize upon one of North Carolina's most valuable, though intangible, natural resources. In attempting to sketch the outlines of this picture the following arrangement of subject matter, with appropriate subheads, seems in order.

- | | |
|--------------------------|------------------------|
| 1. Nature's Contribution | 3. Present Development |
| 2. Economic Importance | 4. Future Objectives |

NATURE'S CONTRIBUTION: The repetitious recital of climatic statistics sometimes leads one to wonder whether the people of North Carolina, and specifically those of its eastern seaboard, really translate these arithmetical measures into terms of human comfort. Perhaps this stems from a failure to apply realistic comparisons with other sections of the country, based, should we say, upon personal reactions to the rigors of a northern winter, the humid heat of a tropic coast, or the searing sun of the western plains. The descriptive term "benign" was applied in a previous section of this report, with statistics to prove it. But aside from personal and sectional preferences it can be agreed that nature has blessed these regions with a "rather wonderful" climate.

Again, it is doubted that enough people recognize the relative "uniqueness" of North Carolina's vast expanse of protected and interconnected waters. Only those of southern Alaska, Puget Sound, the Zuider Zee and the Chesapeake system, come to mind as of comparable scope and character. Perhaps in atonement for nature's failure to provide commodious outlets to the sea, she gave to these inland waters a labyrinth of channels, bays and harbors, each an invitation and a challenge to sportsmen and the weekend navigator alike. Nor did she isolate this boatmen's paradise as a landlocked lake, for with but a few assists from man, it forms the heart and core of an arterial waterway stretching from New England to Florida. Although restrictive to ocean-going commerce the available depths through its inlets and a thousand miles or more of channels, are ample for even the larger pleasure craft.

Most bodies of water of comparable size are either salt or fresh - you accept what nature provided or go elsewhere. But within at most a few hours travel time - for fish or boat - almost any desired degree of salinity may be found. The angler might walk the equivalent of a city block - across an Outer Bank - and choose between surf casting and fresh water fishing. Or he may elect to explore, for a hundred miles or more, the upper reaches of a dozen rivers and their tributary streams which flow into these sounds and estuaries - waters which partake both of the nature of an inland lake and an arm of the sea.

Modern engineering could well be envious of the simplicity yet effectiveness of nature's design and building of those long narrow barriers known here as the Outer Banks. True, in the age old battle the sea may win skirmishes and breach these barriers, yet seemingly repentant of its rages returns patiently to the task of repairing its own havoc. Although minor shifts in their attenuated alignment occur and inlets wander slowly or close abruptly, the enduring nature of these barrier reefs is, perhaps, more surprising than the occasional evidence of their instability. They appear almost as though part of a well thought out plan for a master playground. They protect the inner waters from the ocean's storms, yet control to a nicety the sluice gates through which, at ebb and flow, the life-giving waters from land and sea are commingled into a habitat favorable to its myriad forms. These Outer Banks are nature's causeways past endless miles of white sand beaches broken only at well spaced intervals, with seeming intent to give man access from sea or sound to these inviting strands.

As though these riches were not enough nature borrowed a bit of her tropic waters, pushed them north a thousand miles, and laid them down at our doorstep. The warm waters of the Gulf Stream, teeming with marine life, skirts the outer capes to within an hour's cruise, before veering away into the broad expanses of the North Atlantic. This moving ocean mass and adjacent inshore waters encompass one of the world's most prolific spawning and dispersal areas - a veritable fishermen's paradise.

Opinions may differ as the preponderance of anglers over hunters. In Eastern North Carolina the question is academic in that ample opportunities exist for either, both as to resources and variety. Many forms of wildlife abound, from the larger animals - deer, bear and bobcat - to water fowl and other small game.

Located on a major flyway, the coastal swamps and marshes serve as feeding grounds for vast flocks of migratory fowl. With the advent of better controls these areas should continue to attract bird populations in increasing number. The U. S. Wildlife Service has made excellent progress in developing the extensive Lake Mattamuskeet refuge in Hyde County. For many years this area has been a seasonal mecca for hunters from all over the east. Sportsmen with a flair for the strenuous can find a challenge in many of the eastern lowland forests, such as the Dismal Swamp area, where deer and bear are still plentiful.

ECONOMIC IMPORTANCE: No satisfactory statistical method has yet been devised by which the dollars and cents value may be measured or even those more or less commercial enterprises which serve the tourist trade - out-of-state or domestic. Statisticians of the 5th District Federal Reserve Bank have estimated a total value to North Carolina - presumably of all tourist trade - at \$300,000,000 in 1951. This does not appear to be excessive and probably fails to include many activities such as expenditures by local hunters and fishermen, financial outlays by North Carolinians, as well as those from other states, for the purchase and construction of summer homes and cottages. Nor does it include the subsequent ordinary living expenditures of the many newcomers to the State who have been induced to make this their permanent home by reason of its recreational advantages. This would be especially applicable to the retired group.

The North Carolina Wildlife Resources Commission conducted a survey in 1951 and concluded that an annual direct expenditure of about \$38,000,000 was made by sports fishermen and hunters alone. This again does not appear out of line in view of the fact there were then over 141,000 licensed and approximately 421,000 non-licensed fishermen in the State. In addition there were about 286,000 licensed and 136,000 unlicensed hunters (who hunted only on their own land) and over 50,000 below 16 years of age. The combined total of over a million known sportsmen - and their number has grown considerably since that survey - comprises a very real and important economic factor.

During the last few years licenses and permits alone represented an expenditure of well over a million dollars for the half million or more sportsmen from which such fees were required. In 1952 over \$140,000 was received from some 50,000 non-resident sportsmen for fishing and hunting licenses.

Another important item is the income (estimated at a gross annual value of \$2000 each) to some 2000 coastal fishermen who supplement their commercial fishing activities by chartering or renting their craft for sports fishing purposes. About 150 of these boats devote full time to charter operations during at least part of the year. Rates vary from about \$35 for a party of 5 for close-in fishing to \$75 for Gulf Stream trips.

Contributions from local and through-bound pleasure craft can only be guessed at, and considering the phenomenal rate of increase (the number of boating participants increased about 129 per cent - from 7 to 16 million - during the period 1947-1952) in this type of ownership throughout the country, any statistics applicable two or three years ago would be meaningless today. Each of the esti-

mated 5000 or more through-bound boats may represent expenditures from a few dollars for supplies to a considerable outlay for a protracted stopover, or a major repair job. As has been so often stressed, the real challenge is to increase the inducements for such stopovers and prolong their duration. Natural and mechanical hazards adequately promote repair needs.

Perhaps the most important segment of the tourist dollar is made up of the hundred different services and sales rendered to all classes of the casual traveler, vacationers of short or extended stay, and visitors attending specific events. Although a more direct impact upon the economy is exerted by expenditures of the out-of-state visitor, overall business activities are likewise promoted by recreational expenditures of North Carolina's own people.

Much additional evidence could be cited as to the relative economic importance of this "industry" but it appears safe to conclude that it ranks in value above all agricultural crops except tobacco and well up near the top of the various classes of manufacturing. In the Coastal Plain itself it far exceeds commercial fisheries in both dollar value and number of people dependent upon it for a livelihood. There is every reason to believe that this preponderance will increase materially.

PRESENT CONDITIONS: It is necessary to discuss briefly how the people of this State, particularly those of its Coastal Plain, have improved upon or otherwise conditioned its natural endowments. Weather being beyond man's ability to alter he has left an imprint upon the other two elements of its recreational environment - its waters and wildlife. He has improved channels and harbors, bridged and ferried its streams, stabilized its beaches and lined them with cottages, inns and piers. He has, in some measure, protected its game and furthered the increase of both fish life and fowl. Yet too often in the recent past he has polluted these waters, fouled its harbors and invited the extinction of its wildlife.

State and National Parks, resorts, and other recreational facilities in the Piedmont and Mountain sections will not be touched upon here. Even in the Coastal Plain space permits only limited reference to the several classes of tourist attractions. The State Parks and Advertising Divisions of the Department of Conservation and Development, the State Tourist Bureau, the Wildlife Resources Commission, and other State offices, together with Federal agencies, such as the National Park and U. S. Wildlife Services, have all done excellent promotional work in their respective fields, compiling and broadcasting information on every type of facility.

As to the State Parks, there are the "Cliffs of the Neuse" in Wayne County, a 321 acre scenic and picnicking area and historic Fort Macon, which from Colonial times protected the Beaufort Inlet entrance to Bogue Sound and Morehead City. In addition to regular parks the Singletary Lake Group Camp in Bladen County offers camping, fishing and boating privileges to organized groups. Jones Lake, also in Bladen County, furnishes similar facilities to negro visitors. The State also operates and maintains Bladen Forest and several historic parks and sites such as Brunswick Town, the James Iredell House at Edenton, the Pettigrew State Park in Washington and Tyrrell Counties and the Governor Tryon Palace at New Bern - the first capital of North Carolina.

State owned wildlife management areas are: Angola, (21,000 acres) in Pender County; Goose Creek in Beaufort (5,866 acres); Gull Rock in Hyde (7,500 acres); Holly Shelter in Pender (48,470 acres); Northwest River in Currituck (1,267 acres); and Sandhills in Moore, Richmond and Scotland Counties (60,000 acres). Although most of these areas are closed to hunting some are opened, with restrictions, for certain types of game during season.

Of the State operated hatcheries only two are within the Coastal Plain - Fayetteville, a largemouth bass and blue bream hatchery, and the striped bass (or rockfish) station at Weldon on the Roanoke River.

Federal agencies maintain a number of National parks, forests, game refuges, monuments and historic sites within the Coastal Plain. Nowhere in the world, perhaps, will the view from a single point include the scenes of two events that have had, or will have, comparable impacts upon history than that of a visitor at the site of the first English Colony in America on Roanoke Island looking across the sound to beautiful Kill Devil Hill memorial, marking man's first real conquest of the air. National historic parks may be found also at the battlefields of Moore's Creek and Guilford Courthouse. Covering some 16,000 acres in Carteret, Craven and Jones Counties is the Croatan National Forest.

A new development is unfolding along the Outer Banks which could have a very important bearing upon the future of Eastern North Carolina. This is the Cape Hatteras National Seashore Recreation Area Project, the first of its kind in America. The Director of the National Park Service has stated that "in all probability the Outer Banks would become one of the most interesting tourist objectives in the United States."

The area will extend some 65 miles from Nags Head, past Oregon Inlet and the villages of Rodanthe, Waves, Salvo, Avon, Buxton, Frisco, Hatteras and Ocracoke, ending at the southwestern tip of Ocracoke Island. It will encompass the present Pea Island National Wildlife Refuge and Cape Hatteras State Park has been transferred to the National agency.

An important feature is that the villages themselves together with surrounding area and some built-up sites have been omitted from the boundaries of the park, leaving ample room for future expansion. Also the taking line (150 feet offshore on the sound side) does not continue in front of these villages. From about 4 miles north of Oregon Inlet to Ocracoke the ocean front itself will be in unbroken possession of the Government. Therefore private enterprise is permitted to provide tourist accommodations and cottage developments in the excluded and village areas while the beaches themselves are controlled and kept open to the general public. This may tend to retard the construction of summer cottages but will assist in the adopted policy of retaining the natural attractions of this near-primitive area. With the same objective in mind it is understood that, although the present free ferry service across Oregon and Hatteras Inlets are being expanded, present plans do not include the extension of the existing paved Nags Head-Hatteras highway to include Ocracoke Island.

As of May 1, 1954 nearly 90 per cent of the 30,000 acres needed for this seashore recreation project had been acquired, was under option, or in condemnation. A park superintendent has been assigned and although it may be a number of years before basic facilities are provided it appears that this project will have an increasingly important role in the development of these fascinating Outer Banks.

In this connection mention of a related plan is in order. For many years various organizations and individuals have attempted to interest National and State agencies in the construction of a coastal highway, which, beginning in the vicinity of Norfolk, Va., would follow in part the Outer Banks along the entire seafront of the State and form at least a link in a National highway to the South. This project would, of course, have an important recreational significance.

Construction costs for such a highway would be very high in some of the marshland reaches and stream crossings. Difficulties involved in bridging the several existing ocean inlets might well prove insurmountable in view of their tendency to migrate. The near certainty that new break-throughs of major proportions will occur at intervals in the future must be faced. An alternate solution would be ferry service over the half dozen or more existing gaps and establishment of such service for future breaks. The practicability of interspersing the requisite number of ferry crossings in a 300 mile highway interval would have to be carefully analyzed.

In addition to the present Pea Island National Wildlife Refuge, covering some 5,880 acres immediately south of Oregon Inlet, the National Wildlife Service has developed the very extensive (50,000 acre) Lake Mattamuskeet refuge in Hyde County. The Lake itself - largest in the State - comprises 30,000 acres of the total area. This has become one of the principal wintering grounds for waterfowl on the Atlantic Flyway. Managed hunting and fishing is permitted. A near by adjunct is the 43,000 acre Swan Quarter Refuge.

Among the festivals and local attractions the "Lost Colony" symphonic drama, presented throughout the summer in an outdoor amphitheater on Roanoke Island, is noteworthy. Annual observances commemorative of the Wright Brothers' first flight are held at Kitty Hawk. The Azalea Festival held in early spring at Wilmington brings, among other attractions, a P.G.A. open golf tournament to that city. There is a Potato Festival and a Gold Cup boat race at Elizabeth City and wild pony roundups on Ocracoke Island and the Core Banks. The South Eastern North Carolina Beach Association sponsors annual fishing contests between April and November with worthwhile prizes for the best saltwater catches. In the spring outboard motor boat races are held at Wrightsville and pleasure craft cruises are organized at New Bern. County fairs and other local events occur at frequent intervals throughout the year.

Beach developments have been increasing at a phenomenal rate since the war. Both Wrightsville and Carolina Beaches have been thickly built up on both ocean and sound exposures. Atlantic Beach across Bogue Sound from Morehead City is expanding rapidly to the west. Attractive ocean frontages from Nags Head north are being developed. If and when presently discussed plans mature for a seashore

highway connecting this reach with Virginia Beach and the Norfolk area, access will be given to another 50 mile stretch of ocean frontage.

The larger beaches mentioned above already have attractive year-around facilities for visitors including well equipped marinas at or near these communities. Carolina Beach is particularly noteworthy in this and other respects and could well serve as an example of what can be accomplished with vigorous and enlightened civic leadership. The marina there, and access channels to it, were provided by well directed community efforts. Many smaller beaches - Caswell, Long, Holden, Topsail and Ocean Isle, among them, are developing rapidly.

The faith which people, from both this and adjacent states, have in the future of these oceanfront properties is indicated by the rate at which they are being acquired and the steadily mounting prices, asked and received, for cottage sites. At some of the choice locations property values have doubled and tripled in the last few years.

Except for isolated instances such as Elizabeth City, Belhaven and New Bern, the present picture is not quite so bright at the small interior ports. Some boat harbors and mooring basins, with minimum services, are found but not at all comparable to such as are offered at the privately operated Wrightsville Marina, located directly upon the Intracoastal Waterway. Here almost every facility needed by pleasure craft owners is available, from meals to major boat repairs. Although 60 mooring berths were in place during the 1953 season the owner states that at times an equal number of boats were anchored nearby seeking service. He is doubling the berthing capacity this year (1954). Of course, the adjacent (11 miles) City of Wilmington, as well as tourist conveniences at Wrightsville Beach itself, have been factors in attracting stop-overs; however, this is a fine example of progressive private management.

FUTURE OBJECTIVES: Any realistic program for the better use and development of North Carolina's many natural endowments must take critical cognizance of the present keen and increasing competition for the tourists' patronage. These promotional campaigns are no longer seasonal outbursts but are now round-the-year sales programs, carefully planned by professional agencies who must show a handsome profit for the very considerable sums expended. These returns have proved to be veritable gold mines for many regions in this and other countries, all competing to the extent that for any specific type of recreation the prospective tourist may have many locations, offering approximately equal attractions, to choose from. There is every indication that barring major wars or depressions, this competition is going to increase sharply in the future.

Either of two lines of action suggest themselves. First, increase promotional expenditures, or second, concentrate more on those features in which the State may have an edge over competing fields. Certainly in its inland waters and their environs North Carolina has a natural asset that is nearly unique. The potentialities of these eastern areas have only been touched.

Every year greatly increased numbers of people are discovering the fascinating sport of fishing - perhaps one of the most pleasant of habit-forming practices. Current sales statistics of all types and sizes of pleasure craft indicate that their numbers can be expected to double in the next few years. The tempo of modern living has apparently induced an increasingly greater number of people to seek out-of-the-way places for rest and relaxation or for the location of their cottages. The lure of the ocean and its beaches will continue and grow. With a year-around climate that is a happy compromise between the extremes of north and south it would seem these eastern shores of North Carolina have a competitive advantage which would prove decisive. In fact these water-skirted playgrounds will go far in "selling" themselves as more people see or learn of their attractions.

Occasionally one encounters a local viewpoint casting doubt as to the desirability of inviting all and sundry to share their homeland. For instance a national publication claims that it tried without success to obtain information from one of the small ports as to what pleasure craft facilities were there available. It is true of course, that Tidewater people and particularly the Outer Banker, though friendly, are rather straight-forward individuals and intolerant of pretentiousness. It is not believed that this aversion to the prospects of a tourist invasion is at all wide-spread and unfortunately for those natives who may feel this way, little can be done to stem this flow or reverse its trend.

The present emphasis being given to attracting retired people to this State is an excellent approach and should be particularly effective with service personnel. Among the thousands of young men assigned to the military establishments in Craven, Onslow and Cumberland Counties many are prospective future residents of this State after completing their term of service. Obviously, the lifetime economic contribution of a newly acquired permanent resident far exceeds that of a hundred visitors.

Much can be done outside of promotional advertising to increase the influx of both the casual tourist and new citizens. For instance there have been noted numerous derogatory remarks about unsanitary and ugly waterfront conditions at several of the smaller ports-of-call for pleasure craft. A certain lack of hospitality and aloofness have been evidenced according to some observers.

Even minimum supplies and services for yachtsmen are lacking, or are of difficult access, at many of the small ports. There is need for more small harbors of refuge along certain reaches of the waterways. These need not be excessively expensive - sometimes the dredging of a few thousand cubic yards of material will open up a protected basin. As an example, borrow pits to be opened up in constructing the Manns Harbor bridge approach fills might be made to serve additionally as a mooring basin for small boats. A State operated service or patrol launch would be a welcome sight to the weekend sailor in trouble or lost.

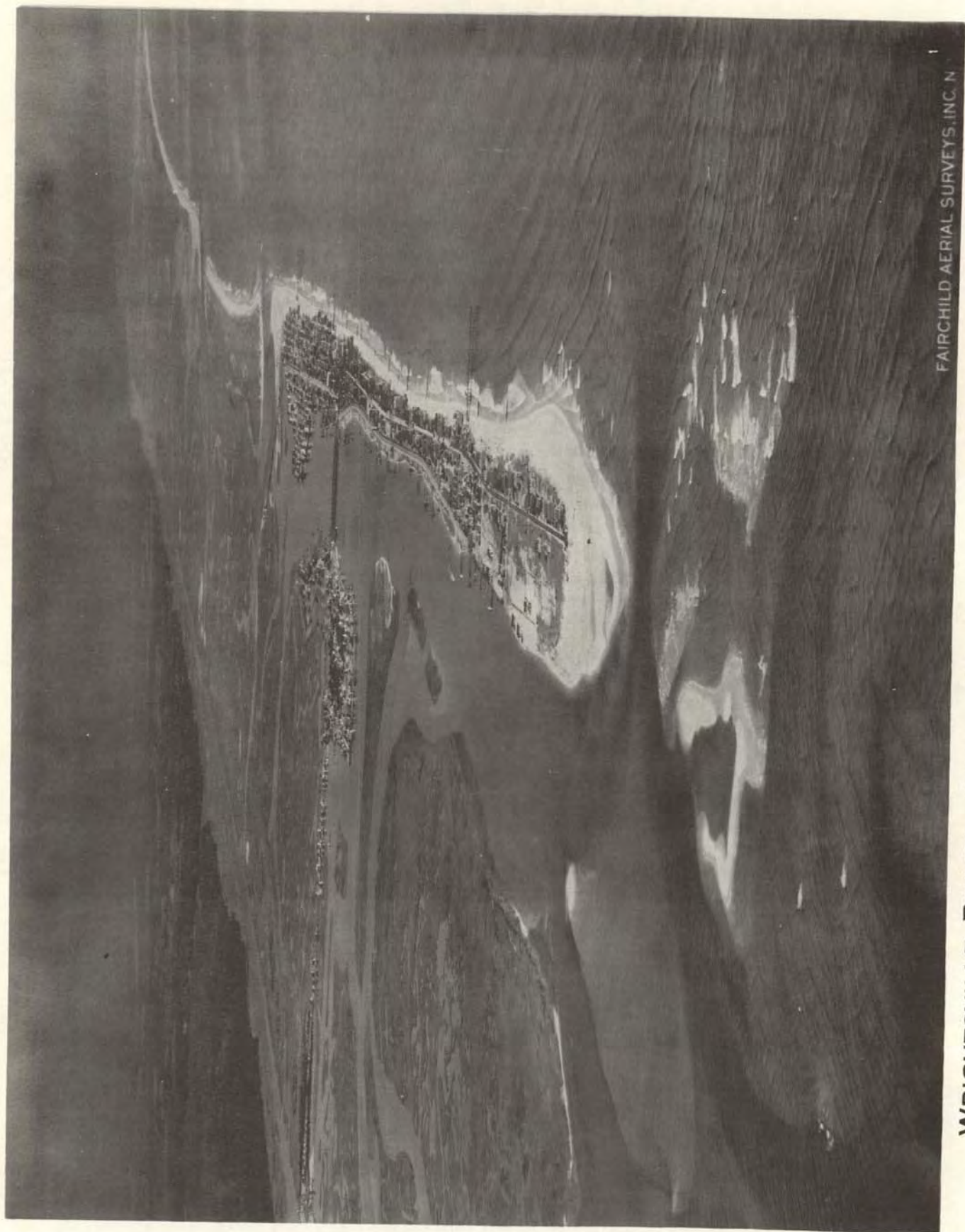
Some method might be found by which an equitable allocation could be made from gasoline tax refunds unclaimed by many through-bound pleasure craft owners. Though not large, these sums could be the start of a needed "Waterway Fund" in support of the above and other programs.

As discussed in other sections of this report less and less dependence can be placed upon obtaining funds and help from the Federal Government for other than the demonstrable needs of water-borne commerce. There is even some threat of abandoning maintenance and operation of the Dismal Swamp Canal route, now so popular with pleasure craft owners. Other states have already anticipated this trend and developed local sources of funds for recreational waterway improvements. The usual sources are gasoline taxes and boat licenses, the theory being that these funds, coming from maritime activities should be spent in their support. In North Carolina 5 cents per gallon of the total 7 cents collected is refunded, upon application, to boat operators and other non-highway consumers. For the 12 months period ending September 1953, refunds to the amount of \$133,570 were made to boat owners. Unclaimed refunds might bring this total to \$150,000.

It has been proposed that instead of refunding these taxes they should be allotted to a "Waterway Fund" and used to support betterment programs in that field only. Similarly, it has been suggested that personal property taxes on water craft, levied by the county, should be abolished and equivalent amounts collected by direct license fees which would likewise be assigned to the Waterway Fund. Voiding of gasoline tax refunds would of course increase operating costs of fishermen using gasoline powered boats. Some of the latter claim that at present they are able to compete with the larger diesel craft only because of this refund differential. As to pleasure craft it is only fair that they should support boating improvements by either or both methods. In any case careful studies should be made of these proposals before appropriate legislation is drafted effectuating the change.

Other sources of revenue might be developed. For instance it appears that the several hundred thousand fishermen and hunters who are not now required to obtain licenses might, in some manner, do more in support of game propagation and wildlife improvement programs.

If advantage is to be taken of North Carolina's imposing recreational potentialities funds in considerable amounts will be needed. Used in well planned programs their expenditure will return dividends many fold in both money and a fuller measure of living.



FAIRCHILD AERIAL SURVEYS, INC. N

WRIGHTSVILLE BEACH — Intracoastal Waterway at upper left — Masonboro Inlet in foreground.

IX. TRANSPORTATION FACILITIES

Discussed below are some salient facts and problems concerning North Carolina's transportation facilities, other than waterways. The latter, being a primary consideration of this report, is reserved for treatment under separate subject headings. Also, in view of the fact that there is at present a concurrent study in progress, devoted exclusively to the public highway program of this State, and scheduled for completion by next (1954) November, no attempt will be made herein to other than touch upon the broader aspects of that program and its relationship to the regional development of the Coastal Plain.

North Carolina's transportation problems and the physical means, present or planned, to meet them, are not too dissimilar from those common in other eastern states. As to highways, they involve the same mounting pressures of a rapidly accelerating demand upon the ability of political units to keep abreast with them. On the contrary, other transportation media are seeking, and in general, can accomodate higher traffic densities. Although various factors are in evidence tending somewhat to restore these imbalances, more positive approaches are needed if transportation is to perform efficiently its vital role in economic progress. This role is too often viewed as merely a necessary evil, an unfortunate item of overhead that must be absorbed by the primary contributions of natural resources, labor skills, and the efficient use of capital. With fuller recognition of the relative values involved, technicians and public officials alike are seeking, with varying degrees of success, solutions for these complex and urgent problems.

Many examples could be cited of the ways through which transportation costs and means can condition the economy and living standards of a region. They may lend advantage to geographical specialization and consequent mass production. They serve to equalize prices and stay the development of local monopolies by giving fuller play to competition. They have a critical bearing upon land use and development. Urbanization trends in the past and the present phenomenon in reverse toward suburbanization are the direct results of adequate transportation. Modern business, demanding efficient marketing and selling techniques, is vitally dependent upon high mobility of both personnel and products. Travel for pleasure, though a direct consumption of transportation assets, is rapidly acquiring highly important economic implications through tourist trade. The principal consideration, however, is that good transportation serves to reduce the cost of production, even though it is in itself a part of that cost, it mattering not whether such is met from public or private sources. The fact that about one-fifth of our total national effort is being expended for transportation services, measures its relative importance.

There are evidences throughout the country of an increasing realization of the interdependence of all forms of transport. Some attempts are being made to integrate these forms with a view to taking advantage of the special capabilities and economies of each. For instance, several railroads have, or are planning, combined truck-rail services, the so-called "Piggy-back" operation whereby loaded truck trailers are transported, minus their tractor units, on regular or specially designed flatcars. Thus door-to-door delivery is obtained without extra handling

and the long-haul advantages of the railroad are utilized without sacrificing the flexibility of the truck. Judging from the apparent success of this arrangement in other sections of the country (e. g., New York, New Haven & Hartford R. R.) it might be presumed that similar methods may be applied to some of the longer north-south truck routes to and through North Carolina.

The proposed sea-land operation (McLean Trucking Co.), discussed elsewhere in the report, would capitalize upon the inherent advantages of both water and highway transport. The existing sea-train companies serve as successful examples of combining rail and ocean-going practices.

These are but a few trends indicative of things to come in the complex field of transportation. These problems must be solved if the South in general and North Carolina in particular are to take full advantage of their many other resources.

AIRWAYS: In dealing with this most modern form of transportation there is temptation to adopt either of two extreme viewpoints: i. e., that it is a relatively unimportant adjunct to the older conventional forms; or that it stands to take over all commodity and personnel movements where the element of time enters critically and weights are reasonable. Adherence to either of these viewpoints would not be conducive to good planning by public and private interests alike. Certainly in the passenger field, and to a lesser degree with respect to air express and lightweight, high-value freight, there is every reason to expect a greatly expanded use of air transportation in the next few years. A neglect to take proper cognizance of this trend will prove costly to many communities.

Often, towns and cities are thoroughly studied by the management of industries seeking favorable branch locations, without local citizens suspecting they are under investigation. The lack of an airport, even a small one and without commercial service, are often the deciding factors in the final choice. The community may be discarded during preliminary planning before it even has an opportunity to consider the prospects of correcting the deficiency.

The increasingly important role of company-owned planes and the air taxi must be given very serious consideration by all communities, large or small, if they expect to take advantage of the present phenomenal growth and realignment of industrial patterns. Again, it is perhaps not realized that there are six or seven times as many airplanes in the service of corporations, used in transporting executive and key personnel, than are operated by all domestic airlines combined - 10,000 as compared to about 1500 respectively in 1952. These company-owned planes flew 23 per cent more hours than the commercial lines. Equipment varies in size from small, single engine four-place planes to the large, four-motored, 30-passenger deluxe types, carrying thousands of executives daily throughout the United States.

Greatly exceeding in numbers the company-owned planes is the large group of privately owned craft, over 60,000 of which were reported in 1952. Many of these are used as air taxis by salesmen, doctors, lawyers, and businessmen in general. The flying salesman, business executive, or trouble-shooting technician

bringing in special skills, short materials, or vital spare parts, have made local air facilities a "must" for forward-looking cities and towns.

A community need not necessarily have scheduled air carrier service certificated into its locality to need an airport; however, if an airport is in place and operating, an application (by an interested carrier) for certification as to public convenience and necessity for scheduled service, may be more easily obtained from the Civil Aeronautics Board if a strong case for feeder service can be presented to that board. In fact, under the liberalized policy of the C.A.B., with respect to feeder lines, instances have occurred where communities have been certificated before construction of their local airport was started.

Proper planning is of prime importance to any community embarking upon an airport program. Location, with respect to the town itself, usually comes first in these considerations. Not only are construction costs critically involved but the field's future success may be jeopardized if the traveler must take nearly as much time between the airport and town as consumed in the air-borne portion of a 150 to 200 mile journey.

There are six airlines offering regular scheduled service to various cities in North Carolina. Of these only four (Eastern, Capital, National and Piedmont) touch Coastal Plain points. Although not as pronounced as with the rail and highway nets, these commercial lines show a similar emphasis upon a north-south orientation. Most flights have termini in the larger cities of the north and south. However, a few feeder flights of Capital Airlines (via Norfolk) touch at Elizabeth City and Rocky Mount and connect with western North Carolina cities. Similarly National Airlines include New Bern and Wilmington in their generally north-south flight schedules.

Piedmont, organized in 1948 with North Carolina capital, has its home office and shops at Winston-Salem. Of the six major companies it is the only one providing a much needed east-west service. This line offers direct connections between Ohio Valley points and several cities in both Virginia and North Carolina, including the Coastal Plain communities of Fayetteville, Wilmington, Morehead City-Beaufort, New Bern and Kinston.

In addition to the cities noted above there are a number of smaller towns having municipal and commercial airports of varying but limited facilities and runway lengths. Much improvement will be needed to place some of these strips in a competitive position with many small air terminals throughout the South.

RAILROADS: The year 1833 marked the opening of North Carolina's first "Railroad," a mile-and-a-quarter strap-iron track to haul building stone from a quarry to the Capitol Building, then under construction. This was followed in 1835 by a line from Portsmouth, Va., to Weldon on the Roanoke River. In 1840 the then longest railroad in the world (161 miles) was completed, connecting Weldon with Wilmington via Goldsboro. Thus at one time Eastern North Carolina had a monopoly on both railroad and water transportation. Numerous railroad projects were undertaken during this period with the State entering the field in various roles from outright ownership and operation to financial assistance through

limited stock holdings. In 1856 the State owned North Carolina Railroad completed a connection at Goldsboro with the Wilmington and Weldon giving access to the Piedmont through Raleigh, Greensboro and Charlotte. This line was extended from Goldsboro to New Bern and Morehead City by the State owned Atlantic and North Carolina R. R. Subsequently these railroads passed to private operation through long term leases (Southern R. R. and the A. & E. C., etc.) but with varying degrees of stock ownership retained by the State. Many other railroad plans were projected, with about an equal number of failures and successes, during the latter Nineteenth Century.

One of the noteworthy features of this long period of development was the almost continuous campaign, by public and private interests alike, to obtain a single one-system railroad connecting Western North Carolina (and Mississippi Valley points) with the Tidewater ports. Even today that ambition has yet to be realized, although the Southern Railway Co. may soon close the last link (New Bern to Morehead City) if its application, now in preparation, to the I. C. C. is approved for acquisition of the Atlantic & East Carolina Railway Co. interests. Even so it does not appear to be the Southern's intention to operate this link as an integral part of their main system, in which case the long-sought east-west connection will not become a reality.

Of the total railroad mileage (4,531 as of Dec. 31, 1952) in North Carolina 3,487 are operated by four principal companies: Southern Railway Co., (1299); Atlantic Coast Line Railroad Co., (996); Seaboard Air Line Railroad Co., (630); and Norfolk-Southern Railway Co., (562). In addition to these four there are 26 other common carriers operating about 23 per cent of the total mileage in the State. Most of these are Class II and III roads although several Class I (annual operating revenues above \$1,000,000) such as the Louisville & Nashville, and the Norfolk & Western, enter the State for short distances.

The State owns 75 per cent of the voting shares of stock of the North Carolina R. R. Co. which extends a distance of 224 miles from Goldsboro to Charlotte via Raleigh and Greensboro. This line is under long term (until 1996) lease to the Southern which operates it as an integral part of its system. The State also owns controlling interest in the Atlantic and North Carolina Railroad Co., which extends 96 miles from Goldsboro to Morehead City and is at present operated under lease by the A. & E. C.

During the past ten years total intra and interstate railroad tonnages have practically doubled. Of particular interest is that for each of these years the tonnages terminating in North Carolina have been about double those originating in the State, although there appears to be a slight trend toward a reduction in this wide disparity. Incoming bulk commodities such as coal and petroleum products account for a considerable portion of the excess, plus the fact that a sizeable tonnage of North Carolina's contributions - for instance pulpwood and paper products - leave the State via water.

The railroad companies are making a marked contribution to industrial expansion in the State. Some of the larger lines have traffic and other technical specialists carrying on day-by-day contacts with prospective industry. These

offer a real service in addition to their purely promotional work, making available much factual data having a critical bearing upon plant location such as site availability, labor sources, water supply and quality, as well as the many incidental items pertinent to new ventures. The Southern claims a 1953 average of over one new firm a day brought to communities served by their lines. Some of the companies have cooperated helpfully in facilitating rail-water interconnections and the establishment of equitable joint rates.

In recent years a number of railroads have been permitted to abandon short sections of their branch lines or eliminate certain unprofitable passenger train runs. In general it would appear that adequate rail service is available to a majority of North Carolina's 400 or more communities. A copy of the State Utilities Commission Railroad outline map has been inserted in the back cover pocket of this report.

HIGHWAYS: North Carolina exercises administrative, financial, and operational control over more miles of road than does any other state. Included in the total of 68,190 miles there are some 11,000 miles of primary highways and about 20,000 of paved secondary roads. The remainder is largely an unpaved network usually assigned in other states to county jurisdiction.

The development of North Carolina's highway system has been, in some respects, quite different from that found in other states. Prior to the 1920's the general inadequacy of its roads was comparable to that encountered throughout most of the country. At that time the State embarked upon a primary highway construction program which, though well planned to cope with conditions then existent, is wholly unable, both as to design and coverage, to meet modern traffic demands. Much of this original primary network is obsolete or approaching obsolescence. The State has been taking steps to correct this situation and is even now engaged in a state-wide survey intended to assist in the development of a comprehensive plan for expansion and improvement. Not only physical requirements are being studied but all related factors, including alternate revenue sources, regional economic patterns, and the influence of other transportation media.

North Carolina has to date avoided the toll system in highway financing. Even the several ferries spanning coastal waterways are provided by the State without cost to their patrons. Although these ferry services are being augmented every year failure to keep apace of the increasingly heavy demands being placed upon them may soon influence adversely the development of some Coastal areas.

In 1931 responsibility over the county road system was assumed by the State Highway Department. Although much progress was made in improving these farm-to-market and feeder roads, it was not until 1949, when proceeds from a \$200,000,000 bond issue became available, that a greatly expanded program was adopted. With secondary road requirements well in hand it is understood that emphasis will be returned to the rapidly deteriorating primary highway situation.

Recent developments in other states undoubtedly will have, if extended to North Carolina, a material influence upon highway use and policies. Adoption of the ton-mileage basis of toll or license assessments against truck traffic, pio-

neered by Oregon, may solve some problems yet, perhaps, precipitate some more serious ones. The seemingly successful rail-truck "Piggy-back" practice may tend toward a deceleration of the rapidly mounting truck traffic densities, particularly on the north-south arterials. If the McLean sea-land operation is inaugurated with a terminus in southeast North Carolina some minor shifts in traffic patterns in that area might result.

This State's highway system is unique in that it serves no great metropolitan areas, yet it links some 300 small communities with less than 5000 population each. It serves less than a dozen cities with more than 50,000 population, while providing interurban facilities for approximately 100 communities having a population of from 5000 to 50,000. This dispersion factor is especially evident in the Coastal Plain, and partially accounts for some increases in the per capita cost for highway construction in certain portions of that area. Another important factor is the cost of road construction in some eastern sections of the State. The highly indented shoreline, with numerous waterways, sounds and extensive marshlands, necessitates expensive crossings and fill stabilizations. The use of ferries is not an entirely satisfactory substitute.

Within the Coastal Plain there are three major north-south highways. These are U.S. 301 in the western sector of the Coastal Plain; U.S. 258 leading from the Norfolk area to Kinston and connecting with U.S. 17 northeast of Wilmington; and U.S. 17 farther east connecting the Norfolk area with Elizabeth City, New Bern, Wilmington and connecting these North Carolina cities with the coastal areas of South Carolina and Georgia. U.S. 301 is the most heavily traveled north-south truck route through the entire State. The highway networks serving Wilmington, New Bern and Elizabeth City provide service comparable to that given other cities of similar size within the State. U.S. Highway Nos. 64, 70 and 74 connect Eastern and Western North Carolina.

Recent traffic counts at control points in the Coastal Plain on some of these primary highways are of interest. In the following table traffic increases and their 1953 make-up, are expressed as percentages. It should be noted that the increase listed for U.S. 64 covers only the shorter period of 1950-53.

TRAFFIC COUNTS BY PERCENTAGES

	<u>U.S. 17</u>	<u>U.S. 301</u>	<u>U.S. 64</u>	<u>U.S. 70</u>
INCREASE - 1946-53	64	160	25	108
PASSENGER - Per Cent of Total	74	76	71	73
Out-of-State	21	38	8	3
COMMERCIAL - Per Cent of Total	26	24	29	27
Heavy Truck - Trans-State	8	3	3	.1

The truck listings above refer to the heavy trailer combinations. The low truck percentage shown for U.S. 70 reflects the effect of New Bern as the control point and the relatively low concentrations of industry and population east of that city on this particular highway.

X. WATERWAY DEVELOPMENTS

EARLY IMPROVEMENTS: The highly indented Coastal Plain of North Carolina, with its network of interconnected natural waterways, has had a very important influence upon the early settlement and subsequent development of the State. Similar influences were operative around the perimeters of the Chesapeake, Delaware and other bays, estuaries and rivers to the north, but with somewhat different end results. With the earlier types of vessels and shipping practices, limited channel depths, widths and alignments were factors of much less critical importance than they became later. During the early periods depths of 10 to 15 feet were restrictive only to larger ocean-going vessels. North Carolina's numerous small inland ports could compete practically on a par with those to the north and south except for one factor - deep-draft access to the sea was limited, even then, to two ports, Wilmington and Southport, and except for entry to the Cape Fear River system these two ports were without a protected waterway connection to the larger Coastal Plain sounds and their tributary channels. Although the areal expanse of the inland waters rapidly promoted the early shallow-draft (about 2 feet minimum) commerce, even by the early nineteenth century shipping began to feel the pinch of restricted depths. In view of the earlier successful operations and the retarded growth of other forms of transportation, numerous minimum, or light draft extensions of the natural waterways, were undertaken by means of snagging and a limited amount of dredging. Some of these projects were initiated at a time when shallow-draft operations, except log rafting, had reached, or even passed, their peak in volume or profitable return. The result, in some cases, was early decadence or abandonment.

Not only were outlets to the sea restricted as to number and controlling depths but, as previously noted, the migration of Outer Banks inlets and the instability of barrier reefs made it impractical to provide dependable channels at these openings, particularly with the equipment then available. In fact, even with modern engineering facilities, inlet stabilization is usually prohibitively expensive and generally entails subsequent high maintenance costs. In contrast, the wide and well buttressed entrance channels to the Chesapeake and Delaware Bays needed little dredging until vessels of deeper draft (25 feet and over) became common. Similarly, their tributary estuaries and rivers, such as the York, James, Potomac, Delaware and others, with many reaches having natural or easily obtainable depths which were just the very few critical feet in excess of those controlling Eastern North Carolina navigation. Although many other economic factors were operative during the last century, the restrictive effects of these relatively small channel depth differentials upon the newly emerging patterns of water transportation began to make themselves felt on the inland waterways of this State some years before similar deterrents became effective along other reaches of the Atlantic seaboard. Before modern waterway improvement in North Carolina could eliminate some of these handicaps the expanding economy of other mid-Atlantic areas tended to pyramid their water-borne tonnages, which increases were used in turn as bases to justify increased Federal appropriations in support of further local improvements.

In addition to the above factors, the indented coastline obstructed the building of north-south railroads and such construction was comparatively costly in the bordering lowlands of the Tidewater area. Therefore, it is understandable that,

paralleling the development of larger and more efficient water-borne carriers, there has been a persistent and continuing demand for waterway improvements.

Even as early as the seventeenth and eighteenth centuries the advantages which would accrue from a protected waterway along the entire Atlantic coast were foreseen and some work was done in the New England area. George Washington made a survey in 1755 for the Dismal Swamp Canal to connect Hampton Roads, Va., with Albemarle Sound. This canal was opened early in the nineteenth century; enlarged and improved during the intervening years by private interests, it was sold to the Federal Government in 1929 and is still in use.

The first actual work by the Federal Government on a protected inland Atlantic route (subsequently known as the Intracoastal Waterway) was done in 1828 at St. John's River, Florida. In the same year work was authorized within the State of North Carolina and the following year a limited program of improvement was begun on the Cape Fear River below Wilmington. During the preceding 8 years (1822-1829) the State of North Carolina had spent approximately \$70,000 on the lower reaches of the Cape Fear River. In 1837 Congress authorized a survey with a view to connecting the southern end of the Dismal Swamp Canal and Winyah Bay, S. C. Another milestone occurred when a second connecting waterway between Norfolk and Albemarle Sound was begun as a private enterprise in 1856. From these small and scattered beginnings numerous improvements at various points throughout Eastern North Carolina have been undertaken during the past hundred years. Since most of these projects were Federal undertakings it will be in order to outline the procedures usually followed leading to the authorization and eventual construction of U. S. financed waterway improvements.

FEDERAL PROCEDURES: The first third of the nineteenth century marked the era of canal building, usually by private enterprise. Railroad construction, beginning in the 1830's, served to decelerate this trend. Even before this the Congress had, by various statutes and enabling acts, recognized the national interest in both river and harbor improvements.

In 1826 Congress passed the first River and Harbor Act containing a specific assignment of responsibility for a waterway improvement to the Corps of Engineers, U. S. Army. Since this earliest assignment the responsibility of the Corps of Engineers has been gradually expanded beyond purely navigation matters to include other related problems such as flood control, beach erosion and certain multiple-purpose projects, irrigation, hydro-electric power, salinity and pollution control, domestic and industrial water supply.

In 1927 Congress appropriated some ten million dollars and directed the Corps of Engineers to investigate and report upon all the principal (some 200) rivers of the nation. During the next 20 years recommendations were submitted as to the best ultimate plan of development for each of these watersheds, with due consideration of all interests involved. These surveys have come to be known as the "308" Reports (House Document 308, 69th Congress, 1st Sess.). Among the North Carolina rivers reported upon were the Roanoke, Tar, Neuse, Cape Fear, Yadkin, Catawba and Broad. Although most of these studies were made in the 1930's a great deal of the basic data and much of the findings are valid today.

As to their scope, investigations with respect to any waterway project are of two general classifications - Preliminary Examinations and Survey Report. As their designations imply a Preliminary Examination involves a study in only sufficient detail to determine whether a proposal has sufficient merit to justify the much more expensive and comprehensive Survey Report. A Review Report is usually for the purpose of bringing up-to-date a previous study of Survey Report scope.

No investigations by the Corps of Engineers, preliminary or otherwise, may be undertaken without the specific authority of Congress, except necessary instrumental status surveys in connection with maintenance work on previously authorized projects. Obviously, no new projects may be started without Congressional authorization and subsequent appropriation of funds by a specific item in the annual Civil Functions Appropriation Act. Certain exceptions are made in emergency situations, particularly in connection with flood control where special funds are provided which may be used, not only on projects having an "authorized" status, but also at locations lacking such recognition, if the emergency is real and poses a serious threat to life, national defense or established economic values.

A primary objective of all surveys, is the determination of a prospective project's economic justification, usually derived and expressed as a numerical ratio of anticipated monetary benefits to estimated annual charges. The latter includes interest (Federal @ 3%; non-Federal @ 3.5%) on the investment, amortization based upon an assumed economic life (usually 50 years), and maintenance costs. In estimating average annual benefits numerous assumptions must be made, particularly with respect to intangibles, future commercial expansion, changing competitive transportation rates and other factors. For instance, although the Congress has recognized that provision for pleasure craft facilities is in the common interest, and therefore accreditable, the basis for evaluating the annual monetary benefits involved must be, of necessity, highly empirical. The approximate formula is from 6 to about 12 per cent of one-half the new value (i. e., straight-line depreciation) of craft which may use the waterway, modified as to the duration of such usage.

Unless a proposed improvement can be shown to have a favorable (over 1.0) ratio of benefits to charges the chances of it being recommended by the Corps of Engineers to the Congress for authorization are very remote. Also, few if any instances have occurred in recent years where Congress has acted counter to the findings and recommendations of the Corps of Engineers relative to the adoption or authorization of new or expanded improvements. Similarly Congress (and the Bureau of the Budget) usually follow quite closely the Chief of Engineers' recommendations as to the assignment of priorities among projects for inclusion in the annual appropriation act. This is important in view of the many hundreds of projects, which though "authorized," must await a specific appropriation of funds before construction is undertaken. Further, under the 1950 Presidential Directive, all public works programs must be carefully screened to include only those projects which directly contribute to national defense or to civilian requirements essential in the changing international situation. This restriction has undoubtedly deferred construction or completion of many worthwhile projects in North Carolina.

No overall River and Harbor and Flood Control Authorization Act, otherwise known as an Omnibus Bill, has been passed by Congress since May 17, 1950. It should be noted that these Omnibus Bills carry authorizations, not only for individual investigations, but also for specific project construction. Concurrently, it has been increasingly difficult to obtain Bureau of the Budget approval and subsequent favorable action by Congress as to funds unless these essentiality criteria are met. For instance, only one small North Carolina river and harbor appropriation item has received the Bureau's approval (\$195,000 for salt water intrusion preventative measures at Fairfield, N. C.), although further hearings before the Public Works Committee of the Congress may result in the inclusion of additional projects.

In addition to directed investigations of specific projects the Corps of Engineers collects and publishes (Part II of the Chief of Engineers' Annual Report) detailed statistics on both domestic and foreign water-borne commerce. These data, covering all navigable waterways in the U. S., are used extensively in estimating the economic feasibility of new or expanded improvements. Conversely, they have a material bearing upon decisions to abandon existing projects where water transportation has failed to develop, or has receded to the point which fails to justify the Federal expense involved. The 1953 Annual Report of the Chief of Engineers states that the operation and maintenance of 66 locks and 30 dams and other structures on 9 obsolescent waterways, have been discontinued. In these instances State or other local agencies are given the opportunity to assume responsibility for the continued maintenance for the facilities if they so desire in view of the strictly local benefits derived therefrom. North Carolina has a number of waterways in, or approaching, this classification. Though not formally abandoned, since no structures are involved, channel maintenance has ceased.

In accordance with Congressional enactments (Dec. 22, 1944, et seq.) all plans, proposals, or reports of the Chief of Engineers, covering new projects, must be submitted to the governors of the states concerned for comment before presentation to Congress. The same act authorized the establishment by the Secretary of the Army of recreational facilities within reservoir areas, but with the stipulation that the administration of such facilities must be consistent with State game and fish laws. Some states, particularly in the west, have taken practical advantage of these provisions with a view to bringing Federal and local planning into conformity. North Carolina should make fuller use of this opportunity as its river basin (e. g., Neuse River Authority) planning program is expanded.

Corps of Engineers endorsement of a proposed project is usually made contingent upon some degree of local cooperation or contribution. Reservoirs for strictly flood control purposes generally constitute an exception to this rule. This requirement may range from merely holding the United States free from damages to the furnishing of rights-of-way and spoil areas, or even, in special cases, (if benefits are predominately local) an actual cash contribution. Also, a frequent prerequisite in navigation improvements is the provision by local interests of public terminal facilities.

Another aspect of local cooperation with activities of the Corps of Engineers is concerned with beach erosion studies and preventative measures. The River

and Harbor Act of July 3, 1930, (Public No. 520, 71st Cong., et seq.) established a Beach Erosion Board composed of Army and prominent civilian engineers with authority to conduct surveys and evaluate the extent of Federal participation and interest, if any, at threatened coastal points. Studies are undertaken upon approved applications from, and in cooperation with, local agencies. Subsequent Congressional enactments established Federal policy to participate in the construction of protective works at publicly owned beaches up to one-third the total cost. Maintenance of such works by the United States was excluded, as was participation in any protection program for privately owned shores. The above acts were the bases for the recently (1948) completed North Carolina Shoreline, Beach Erosion Study and Report (House Doc. No. 763, 80th Cong., 2nd Sess.).

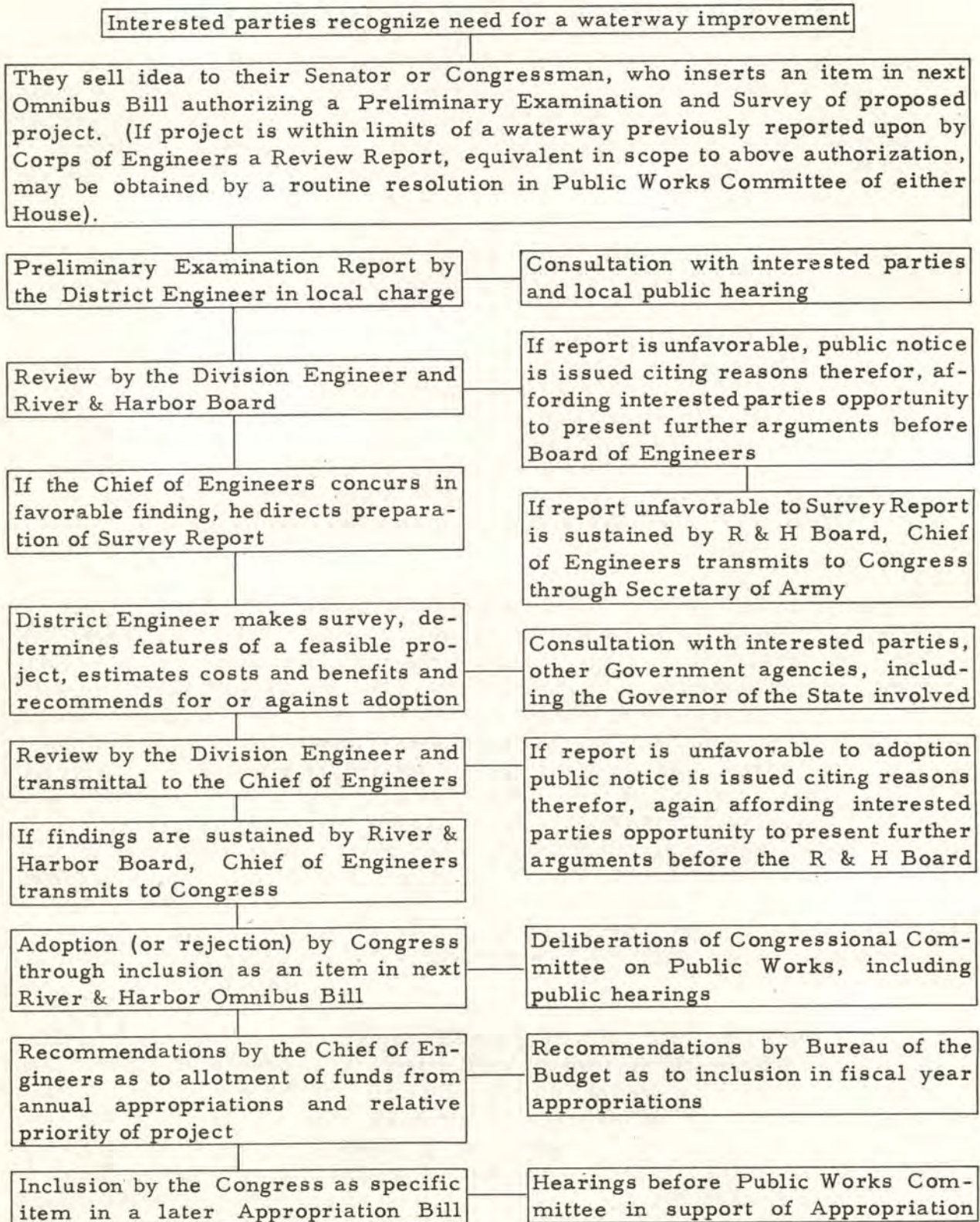
Recently curtailed appropriations have brought about a renewed interest in a provision of the River and Harbor Act of March 3, 1925. The pertinent extract from that act reads as follows:

"Section II. That whenever local interests shall offer to advance funds for the prosecution of a work of river and harbor improvement duly adopted and authorized by law the Secretary of War may, in his discretion, receive such funds and expend the same in the immediate prosecution of such work. The Secretary of War is hereby authorized and directed to repay without interest, from appropriations which may be provided by Congress for river and harbor improvements, the moneys so contributed and expended* * *"

Although in the past this provision was used frequently by local interests to advance construction on favored projects, recent developments and policies had, by fiscal year 1949, all but eliminated this procedure. Inquiries submitted to appropriate authorities indicate that the Corps of Engineers, the Secretary of the Army, and the Congress, have since World War II, frowned upon and persistently resisted any effort by local interests to proceed with an authorized project on the basis of local advancement of funds and subsequent reimbursement. In certain respects the procedure might be viewed as an infringement upon the appropriative function of Congress. This is particularly true in recent years since Congress has modified its former practice of lump-sum appropriations delegating the allocation responsibility to the Chief of Engineers and now assigns funds to specific, authorized project. In other words, should a project be now undertaken and completed with funds advanced by local interests under the provisions of Section II, reimbursement of such funds could be made only through an appropriation for that specific project.

The following flow-chart summarizes the rather involved procedure by which a waterway improvement, desired by local interests, is processed from conception to construction. Reference is made in this chart to the Board of Engineers for Rivers and Harbors, sometimes abbreviated as the "R & H Board." This is a consulting group comprised of senior Army engineers, drawn from the entire Engineer Department (U. S. E. D.) who meet periodically in Washington, D. C., for the purpose of reviewing and submitting formal recommendations to the Chief of Engineers (C. of E.) on such projects as may be presented to the latter by the field Districts and Divisions.

PROCEDURES LEADING TO AUTHORIZATION BY THE FEDERAL
GOVERNMENT OF WATERWAY PROJECTS



In summary, due recognition should be given to a recent policy trend in Congress to curtail funds for both survey reports and authorized construction projects. In this connection it is in order to quote in part from an opening statement made by General Sturgis, Chief of Engineers, before the Sub-committee for Rivers and Harbors of the House Public Works Committee, on February 2, 1954.

"I have given the matter to our navigation survey report program and, in fact, our general survey report program, very serious consideration. I am deeply concerned about the large backlog which has resulted from the study of projects assigned to us by Congress and the relatively limited amount of funds which have been appropriated to carry on this work. The rate of survey investigation work permitted by appropriations for the last several years for our general survey program has been only sufficient to carry on about 10 per cent of our backlog. This is true of both flood control and navigation reports. For example, the total number of navigation studies now, in our field offices is 377. The total estimated cost of this planning is \$10,752,000, of which \$5,892,000 has been made available through the fiscal year 1954, and \$4,860,000 remains to complete. In the fiscal year 1952 there was no appropriation for general navigation studies. In fiscal year 1953 the appropriation was \$500,000. The appropriation for the present fiscal year is \$330,000. The approved budget estimate for general navigation studies for fiscal year 1955, which is now being considered by the House Appropriations Committee, is \$275,000, which we have estimated tentatively will permit work on 30 reports. Of these reports which will be financed with fiscal year 1955 funds, we anticipate that only 21 will be carried to completion and 9 will be continued."

The above statement has direct implications with respect to North Carolina projects and surveys. There are some 27 authorized and incomplete river and harbor projects in this State. Funds in the estimated amount of 12 million dollars would be required to complete the authorized new work. In addition there are 5 worthwhile projects which have been recommended to Congress for authorization which will cost not less than \$400,000. As to current prospects for funds in support of these projects only one of them (\$195,000 for the Fairfield pumping plant) has been approved by the Bureau of the Budget for inclusion in fiscal 1955 appropriations. During the present fiscal year the District Engineer at Wilmington received an allotment of only \$1,500 with which to carry forward authorized Preliminary Examinations and Survey Reports on some 30 proposed projects. Although estimates are not available, these studies may eventually cost several thousand dollars.

In view of the above considerations and the steadily mounting backlog of fairly high priority projects throughout the country, at least two conditions must be met if North Carolina improvements are to reach the construction stage during the next few years, particularly if present strictures related to the international situation are continued. First, the project must have a high ratio of economic justification with widespread benefits, at least indirectly connected with national defense; and two, these facts must be clearly demonstrated to the satisfaction of the appropriate committees of Congress. A corollary to these conclusions is that

for at least the next 5 to 10 years, any realistic program for better utilization of North Carolina's inland waterways should be predicated, in large measure, upon existing project conditions, and with prospective Federal contribution generally limited to priority maintenance operations.

Fortunately this State already possesses a network of excellent, or near adequate navigable channels, which can serve as an immediate basis of expanded water-borne commerce as well as future planning. In fact there are few, if any, other states in the country which can match North Carolina in total miles of improved or natural waterways capable of meeting the usual range of shallow-draft traffic demands (6 to 12 feet). The extent to which use is made of these free transportation networks within the State, as measured in traffic density or tonnage moved per mile of available waterway, is much less favorably comparable to that of other regions served by navigable channels.

In attempting to determine whether correctable conditions exist which are not conducive to the growth of commerce on the subject waterways, a summary of present facilities, and the extent to which they are used, is in order. In Appendix A factual data are presented with respect to the 44 federally authorized waterway improvement projects in North Carolina. The officially adopted designations and limits are used in order to insure the applicability of data and maps made available by the Corps of Engineers, U.S. Army - the Federal agency having administrative jurisdiction. These designations are, in certain instances, somewhat less definitive geographically, than might be desired. Also, rather unrelated additions to previously authorized projects have been made, such as those carried as sub-projects of the Atlantic Intracoastal Waterway. The index map, showing the project names, underlined in red, should be helpful in this respect.

In Appendix A, after a somewhat special treatment necessitated by the out-of-state interconnections of the Atlantic Intracoastal Waterway, individual maps of the remaining projects are presented, accompanied by a condensed descriptive and statistical outline with respect to: location, previous projects, existing project, progress, variation of water surface, controlling depth, cost of construction and maintenance, and commerce carried.

Of the 50 or more authorized projects and sub-projects for which maps and pertinent data are included in Appendix A, 26 are incomplete and will require additional appropriations. Of these 26, fifteen are classified as active projects and have been tentatively assigned group priorities by the Chief of Engineers and the Bureau of the Budget. The remaining 11 previously authorized projects, or sub-projects, have been deferred until further investigations can be made as to feasibility, present need, or desirability of changing the authorized plan of improvement. In addition, five proposed projects have been favorably recommended by the Corps of Engineers and at the present time four of these have received Congressional subcommittee approval for inclusion in a forthcoming omnibus bill of authorization.

INCOMPLETE AUTHORIZED PROJECTS: Again it should be stressed that any general priorities, presently allocated to the first group of 15 incomplete projects, are highly tentative and subject to radical changes which might result from altered local conditions or the expressed desires of the communities and State or

Congressional authorities. This tentative listing of priorities is prepared each year for six years in advance and the projects are grouped on the basis of future fiscal year appropriations. It must be pointed out however, that unfortunately most projects receive funds later than anticipated rather than before, in the six-year-plan scheduling. This is usually due to the frequent intervention of emergency work and, of course, the present restrictions on appropriations based upon National defense needs.

In the following table these 15 projects are listed in order of the fiscal years during which it is anticipated funds to complete (or partially complete) will be requested from Congress. Also listed are the additional funds required, based upon the most recent estimates - usually 1953. It is understood that some of these estimates are being revised upward due to rising construction costs. To facilitate reference, the House or Senate document number is shown, including the pertinent Congressional session, on which authorization was based. These documents are in essence the printed reports of the Chief of Engineers and his field officers, together with letter of comments by the Bureau of the Budget, Secretary of the Army, and the Governor of the affected State. Also included are pertinent maps and drawings of the proposed projects. An additional reference is made in the table, where possible, to the serially numbered project map and accompanying data sheet in Appendix A which pertains to the listed project. It will be noted that in several instances the tabulated improvement is merely a minor addition to a major overall project such as the Atlantic Intracoastal Waterway. In these cases the Appendix A maps are usually too small in scale to properly show the details of work proposed. In such instances the appropriate House Document, with its accompanying maps, may be obtained from the Public Printer in Washington, D. C., if detailed information is required. The official project titles have been somewhat abbreviated in certain instances.

INCOMPLETE AUTHORIZED PROJECTS

(Six-year schedule of anticipated funds)

PROJECTS OR SUB-PROJECTS	FUNDS TO COMPLETE	FISCAL YR. FUNDS	H. or S. DOC. NO.	APP. A NO.
Fairfield Drainage	\$ 195,000	1955	823-80-2	1
Wilmington Harbor	2,093,700	1957	87-81-1	42
Far Creek (Engelhard)	178,500	1958	770-80-1	18
Taylor's Creek (Beaufort)	82,200	1958	111-81-1	35
Back Sound to Lookout	105,000	1958	746-77-2	36
Manteo to Oregon Inlet	1,104,800	1959	310-81-1	14
Masonboro Inlet	425,300	1959	341-81-1	1
Beaufort Harbor	72,000	1959	334-76-1	35
Thoroughfare to Cedar Bay	30,000	1959	87-76-1	31
Rollinson Channel	55,000	1960	236-76-1	23
Marshallberg Harbor	26,300	1960	68-81-1	33
Pamlico Sound to Rodanthe	45,000	1960	234-76-1	16
Harkers Island Channel	90,300	Indef.	99-77-1	33
Mooring Basins (Six)	48,000	Indef.	660-76-3	1
Swan Quarter Channel	50,000	Indef.	239-76-1	19
TOTAL FUNDS	\$4,601,100			

INDIVIDUAL PROJECTS: In the following discussions some salient features of the fifteen incomplete projects listed above are touched upon, together with various considerations bearing upon their status and relative priorities. Additional information will be found in Appendix A, as to work proposed, percentage of completion, project and controlling depths, funds expended for both new work and maintenance, and commercial statistics. Understandably, it is impossible within the scope of the present study to collect, analyze and present sufficient supporting data which would justify views counter to the published reports and recommendations of the Corps of Engineers, insofar as project feasibility, costs, and economic justification is concerned. However, as noted above, priorities are not sacrosanct and it is within this field that State and local interests can effectively influence the programming of waterway improvements within the State.

The Fairfield Drainage Sub-Project is the only North Carolina river and harbor item included in the recently passed Civil Works Appropriation Bill for the fiscal year 1955. It pertains to the installation of a pumping plant and other facilities for the prevention of salt water intrusion in the vicinity of Fairfield and Mattamuskeet Lake. The Federal cost was placed at \$195,000 as compared to a 1947 estimate of \$115,000 and is exclusive of about \$12,000 in costs to be met locally. The proposed work was justified by the Corps of Engineers on the basis that the construction of the nearby Intracoastal Waterway has been responsible in some degree for increased and destructive salinity in local drainage canals; however, no actual waterway improvements are involved.

The Wilmington Harbor dredging item pertains to the provision of 34-foot (35 feet across the ocean bar) channel depths as authorized. The 32-foot channel above Castle Street has been indefinitely postponed as noted in Appendix A.

Far Creek is the official designation for the access channel from Pamlico Sound to Engelhard. This project is rightly accorded a high priority in view of the restrictions imposed by present controlling depths of about 7 feet, upon the recently inaugurated bulk-grain shipments out of that port. These serve the eastern portion of Hyde County which is without railroad connections. Barges at present can be loaded to only about 75 per cent capacity with adverse effects upon costs for the Baltimore haul. The 1946 estimated cost of \$80,600 has been more than doubled to a present \$178,500.

The Taylors Creek Sub-Project was recently separated administratively from the Pamlico Sound and Beaufort Harbor Channel Project and made part of the Beaufort Harbor Project, to which it logically belongs. The present controlling depth of 7 feet, or less, has been a very serious obstacle to fishing activities and particularly menhaden boats. Groundings, resulting in severe losses, are frequent for craft using this shorter and protected route to Back and Core Sounds. The Taylors Creek Sub-Project is fully deserving of the relatively high priority accorded it. It is probable that the cost of this work, estimated at \$82,200 in 1948 would be materially increased on the basis of present conditions.

The Back Sound to Lookout Bight Channel authorization increases the previously provided depth of 5 feet to 7 feet. It is unfortunate that this channel has

proven so difficult to maintain in view of its strategic location as protected line of retreat for fishing craft when caught off Cape Lookout by threatening weather. After the originally authorized 5-foot channel was provided in 1937, necessary maintenance, though very high (\$40,000) during the first year, showed a later tendency to decrease somewhat; however, it was estimated that such costs would continue at about \$25,000 annually. Such amounts were expended in both 1945 and 1946. If the existing depth of five feet is increased to the authorized seven it is possible that these annual charges might be further reduced, although this is far from certain. The interacting hydraulic forces involved here are too complex for solution, other than by the construction of a scale model. This should be done in view of the very important role this channel could fill if the full potentialities of the off-shore fishing grounds are to be realized. This is particularly true considering the precarious and unstable conditions existing at Drum Inlet - the only other opening through the Outer Banks between Beaufort Harbor and Ocracoke.

The Manteo to Oregon Inlet Project authorizes some 24 miles of 12-foot channels including a 14-foot depth through Oregon Inlet and the ocean bar. Present controlling depths are generally about 6 feet or less. This project is only about 7 per cent complete and existing conditions seriously affect boat traffic throughout the entire eastern Pamlico Sound area.

The Masonboro Inlet Sub-Project (near Wrightsville Beach - see aerial photograph opposite page IX-1) is divided into two separate items for budgetary purposes. The work referred to in the above table consists of the 12 to 14-foot channels through the inlet and connecting with the Intracoastal Waterway via Banks and Motte Channels. Provision of the ocean jetties has been deferred until it can be determined whether this inlet can be kept open by dredging alone, in the hope that the much more expensive jetty construction can be avoided. Since the channel work has not been done, due to restrictions on appropriations, there has been, as yet, no opportunity of determining the effectiveness of the dredging alone. In the meantime there have been numerous complaints about the rapidly shifting shoals across the ocean bar and through the inlet, with controlling depths reduced to 4 or 5 feet and channel markers out of place. As a result of these complaints the U. S. District Engineer Office at Wilmington made a hydrographic survey of the inlet channels in April, 1954 and found that a minimum depth of 8 feet at mean low water was available over ample widths. Of course these presently favorable conditions could change quickly as a result of storms or shifting of the outer bar. These unstable conditions are faced at all the inlets and their interior approach channels. The closing or extensive deterioration of Masonboro Inlet would be a very serious matter to the numerous local craft which are dependent solely upon this access to the ocean.

The Beaufort Harbor item is in addition to the Taylors Creek Sub-Project discussed above. (See Appendix A, No. 35, for details). While not as critically needed as the work in Taylors Creek, nevertheless present mooring space in the harbor is inadequate for the numerous fishing and other craft which use this port. The uncompleted work of enlarging the basin in front of the town will assist materially in relieving this congestion.

The Thoroughfare Bay to Cedar Bay connecting channel authorization, providing for 7-foot depths instead of the present 5 feet, is proposed to save the longer trip via Wainwright Slough for fishing boats drawing more water than the present channel will accommodate. The Wainwright Slough route from Pamlico Sound to Atlantic is not only longer but much more exposed in bad weather, which sometimes delays loaded boats to the extent that cargos spoil. Although authorized in 1945 no new work has been done since the original 5-foot project was completed in 1921.

The Rollinson 6-foot Channel was completed in 1936; however, no work has been done on enlarging the basin at the town of Hatteras. Local interests are perhaps more interested in the outcome of a recently completed review report as to the feasibility of a proposed addition to this project which would provide a direct channel connection between the harbor and Hatteras Inlet, plus breakwaters at or near the harbor entrance. The Chief of Engineers transmitted his report to Congress on May 24, 1954. Although not yet printed this report recommends against the provision of the direct channel connection as failing of economic justification. However, he does recommend a breakwater, somewhat modified from that desired by local interests, at an estimated Federal cost of \$175,000 and a non-Federal cost of \$2000 for necessary rights-of-way. On June 17, 1954 the recommended improvements were passed upon favorably by the House Public Works Committee and presumably will be included in the forthcoming omnibus river and harbor bill.

The Marshallberg Harbor Sub-Project is part of the Pamlico Sound to Beaufort Harbor channel authorization. It was adopted by Congress under the May 17, 1950 River and Harbor Act, with the provision that local interests provide, at their own expense, suitable space for a public landing at Marshallberg, which would be open to all on equal terms. No work has been done on the approach channel or harbor.

The Pamlico Sound to Rodanthe Project was authorized in 1945 and like others, with its relatively low priority, will have to await its turn for funds. This improvement will have increasing importance when the Hatteras National Seashore Recreation Park area is fully opened and operating. Much of the freight coming into Rodanthe moves by water and the use of the harbor by fishing boats, particularly the deeper-draft "buy" boats, make this improvement of considerable importance to local interests.

The Harkers Island Channels Sub-Project is also a part of the overall Pamlico Sound and Beaufort Harbor Project. The purpose of the two short cut-off channels at the east and west ends of Harkers Island is to save some 8 and 2 miles, respectively, for fishing boats using the Back Sound and Lookout Bight passage to and from the ocean. It was on the basis of time and expense which would thus be saved that this sub-project was recommended to Congress in 1941. Local interests also claimed that these channels would increase the flow of ocean water into that portion of Core Sound between Harkers Island and Drum Inlet, thereby creating conditions more favorable to the propagation of finfish and shellfish in this area.

The Six Mooring Basins were authorized in 1945 as part of the overall Intra-coastal Canal Project. The purpose of the structures would be to provide points

at which extra barges could be tied up near restricted (by reason of poor channel alignment, drawspans and cross currents from side channels) sections of the Intracoastal Waterway, while the towboat negotiated these sections with a single barge. Also extra barges would be left while deliveries were made to off-waterway points such as at Morehead City, Beaufort, Swansboro, Jacksonville and Wilmington. They would be located just off and parallel to the main waterway channel and would consist of a row of five-pile dolphins spaced 30 feet apart along a line 300 feet long, with angular approaches at each end terminating in a seven-pile cluster. Although these mooring basins were authorized, at a total estimated cost of \$24,000, in 1945 (1953 estimate \$48,000) no work has been done to construct them.

The Swan Quarter Bay to Deep Bay Project, originally authorized for depths of 6 feet, was revised in 1945 to 8 feet. No work has been done to provide the extra depth although local interests have stressed the need. The 1945 estimated cost of \$22,500 has been increased to \$50,000.

COMPLETED PROJECTS: It will be noted in Appendix A that about 20 authorized waterway projects in North Carolina are carried by the Corps of Engineers as officially complete. Although all specified work may have been finished this does not mean that maintenance is discontinued even though such work has been considerably reduced in recent years, due to restricted funds. Also, extensions or revisions to the original project may be authorized during, or subsequent to, its completion. The necessary procedures are considerably simplified in obtaining authorization for additional work or sub-projects, provided these can be administratively tied to an existing project. A routine House or Senate Committee resolution furnishes the requisite authority to conduct an investigation of the proposal and for the preparation of a review report, if and when survey funds become available. Although some degree of relationship must exist between the original project and the desired supplement the latter need not be within the actual physical limits of the former. The essential reason why this simplified resolution procedure is possible in the above instance is not because of the authorized status of the original project but is due, rather to the fact that there must have existed a previously authorized survey report upon which a review report, dealing with the new proposal, can be based. Advantage should be taken of these circumstances in appropriate cases.

Drum Inlet is an example of where the above procedures could and should have been applied some time ago, in view of the serious conditions developing there. The official Drum Inlet Project is carried as completed by the Corps of Engineers (see Reference No. 32 of Appendix A) and therefore does not appear among the list of 15 uncompleted projects tabulated above. In fact Drum Inlet proper is not within the prescribed limits of the Federal project, which calls for a channel 200 feet wide and 12 feet deep, extending from the improved channel in Core Sound, about one mile, to the inlet gorge where it terminates, leaving Drum Inlet itself outside present Federal responsibility. Although the Wilmington District Engineer reported 7-foot depths available across the ocean bar and 7.4 feet in the improved channel at the end of fiscal year 1953, with no recent complaints from local interests, reports from the area indicate that shoaling has occurred both within the inlet and extending soundward, so that the project channel is seriously threatened.

In attempts to keep the approach channel open considerable maintenance dredging has been required almost yearly. In fiscal 1948 about \$57,000 was expended for the removal of 185,000 cubic yards of material. In 1950 some \$31,000 was spent, followed by \$36,000 for the removal of 100,000 yards in July and August of 1952. These are relatively large sums considering that the total funds allotted to the Wilmington District for all projects (new work and maintenance) in North Carolina, including the deep-water ports, amounted to less than \$1,000,000, during the current (1954) fiscal year.

The important fact to be noted is that there is no existing authority for the Corps of Engineers to perform any work - new or maintenance - seaward of the inside throat or gorge of the Drum Inlet. Neither is it possible to make a preliminary examination without Congressional authority. It is unfortunate that local interests did not request such a study several years ago. Since there is an existing survey report - that on which authorization of the channel was based and published as House Document 414, 75th Congress, 2d Session - authority for a review of this previous report, with specific reference to the inlet itself, can be rather easily obtained by a routine House or Senate resolution. Of course under present policies the actual survey might have to wait some time for an allotment of funds, but in view of its importance steps should be taken without delay to initiate it.

INACTIVE OR DEFERRED AUTHORIZED PROJECTS

PROJECT OR SUB-PROJECT	FUNDS TO COMPLETE	H. or S. DOC. NO.	APP. A NO.
Masonboro Jetties	\$1,590,000	341-81-1	1
Trent River Boat Basin	19,100	623-77-2	29
Jacksonville Channel	267,100	421-80-1	1c
Snow's Cut Tidal Lock	1,750,000	660-76-3	1
Roanoke River above Palmyra	233,900	694-75-3	10
Chowan River	30,000	101-76-1	5
Wilmington above Castle St.	505,800	83-76-1	42
Pembroke Creek	15,000	235-76-1	8
Neuse River at New Bern	40,000	299-67-2	26
Lockwoods Folly River	147,700	1890 Act	43
Morehead City Harbor	<u>2,875,000</u>	1937 Act	34
TOTAL FUNDS	\$7,473,600		

The Masonboro Jetties, as discussed above, are being deferred in the hope that dredging operations alone may be successful in keeping this inlet open.

The Trent River Boat Basin item at New Bern was added to the original Trent River Project in 1945, on the basis of a 1941 review report which contained the requirement that local interests would provide suitable bulkheads, boat slips, walkways, road access, and other facilities equivalent to a modern marina, for servicing boats, but open to all on equal terms. It was then estimated that these boat facilities would cost about \$24,000. Dredging of the basin and access channel was estimated at \$16,500, of which local interests would be required to con-

tribute one-third, but not to exceed \$5,500. Subsequent to the 1945 authorization New Bern officials wanted to change the location of the boat basin somewhat, to a site on Lawson Creek. Before authorization for this change of plan could be obtained altered conditions along the waterfront (including the abandonment of the Municipal power plant and the replacement of the U. S. Highway No. 70 bridge) made the shift to Lawson Creek less desirable. The matter is again under study by the City of New Bern and although no final commitments have been made by the community with respect to meeting the above requirements of local cooperation, it is to be hoped that the way will soon be cleared so that this very desirable inducement to tourist-craft trade may be provided.

The Jacksonville and New River Inlet Channel Sub-Project (part of the Intracoastal Waterway) increased the original authorization for a 10-foot project to 12 feet, but added the stipulation that the town of Jacksonville would be required, among other things, to provide adequate terminal facilities, open to all on equal terms. Lack of assurances that the above local cooperation would be forthcoming has not been, necessarily, a deterrent to completing the 12-foot channel. This deferment is due, rather, to shortage of funds and the fact that very little commerce has yet to take advantage of the existing 10-foot channel. A maintenance dredging contract is at present being prepared to restore 10-foot depths in the lower 4000-foot reach of New River where the latter joins the Intracoastal Canal.

The Snow's Cut Tidal Lock proposal (Sub-Project under the Intracoastal Waterway) has met with determined opposition by navigation interests as being restrictive to traffic. The tidal lock in the Intracoastal Waterway cut between Myrtle Sound and the Cape Fear River was an alternate solution to the provision of an opening in the barrier separating the sound from the ocean for the purpose of restoring suitable salinity and sedimentation conditions in the sound for the benefit of oyster culture, allegedly destroyed by the open cut. The City of Wilmington once objected to the barrier opening as a threat to their Cape Fear River municipal water supply source - later moved upstream - plus the possible invasion of the port by teredo (a marine borer very destructive to piling), unless a tidal lock were placed in the cut so as to intercept salt water intrusion from the sound. Considerable differences have developed among the several conflicting interests here and this situation, plus the high cost of the lock as compared to the relatively small benefits to oyster propagation in the sound, has led to the deferment of this sub-project. In the meantime local interests have provided a small opening between the sound and ocean just above Carolina Beach, which appears to be holding well to date.

The Roanoke River 5-foot Channel above Palmyra to Weldon has been adjudged by the Corps of Engineers as impractical of attainment by dredging, snagging and regulation. The present controlling depth above Palmyra is at present about one foot and this extension has been indefinitely deferred.

The Chowan River Project has been deferred principally, perhaps, because of the present availability of 11-foot controlling depths from the mouth to the upper end of the project at the confluence of the Nottaway and Blackwater Rivers in Virginia. Future action may depend somewhat upon further improvements of the Blackwater tributary.

The Wilmington Harbor deepening above Castle Street has been indefinitely deferred as noted above.

The Pembroke Creek Channel extension would have served the U. S. Fish Hatchery at Edenton. This facility is being discontinued and as yet no work has been done on this project.

The Neuse River Project is considered by the Corps of Engineers as being impractical to complete above New Bern by snagging and dredging.

The Lockwoods Folly River Project is at present being restudied under a new survey report authorization. (See Holden Beach - under "Current Investigations" below).

The Morehead City Harbor Project was recently restudied and during the past few months the Chief of Engineers has recommended to Congress that the project depth be increased to 35 feet.

RECOMMENDED PROJECTS: In the following table there are listed those projects which have been recommended to Congress for adoption but which have not as yet been authorized. No small scale maps applying specifically to these new proposals are available; however, the referenced Appendix A maps show the general locations involved.

PROJECTS RECOMMENDED BUT NOT AUTHORIZED

PROJECT OR SUB-PROJECT	EST. COST	DOC. NO.	APP. A NO.
Smith Creek (Oriental)	\$102,000	170-83-1	6
Wallace Channel	108,000	453-81-2	30
Peltier Creek	40,000	379-81-1	25
Hatteras Breakwaters	175,000	Not Printed	--
Belhaven Harbor	13,500	389-82-2	17
TOTAL COSTS	\$438,500		

The Smith Creek breakwater improvement is to be an extension of the existing project (see Appendix A - Ref. No. 30) approved in 1910 which will provide a rubble-mound breakwater to protect the harbor of Oriental. The review report of 1953 (published as House Document No. 170, 83d Cong., 1st Session) concurred in the request by local interests for the breakwater but did not recommend the requested deepening of the channel and boat basin. Favorable action was taken by the House Public Works Subcommittee in May and there is every assurance this work will be included as an authorized project in the forthcoming omnibus bill.

The Wallace Channel improvement was also given a similar approval by the Congressional subcommittee and undoubtedly will be authorized. The related Cross-Rock Channel proposal, desired by local interests, could not be economically justified by the Corps of Engineers and was not included in their 1950 recommendation to Congress.

The Peltier Creek Sub-Project involves the improvement of a small creek and boat basin just west of Morehead City, giving access to the Intracoastal Waterway. This sub-project has received Congressional Subcommittee approval and should be included in the next authorization bill.

The Hatteras breakwaters were discussed above in connection with the incompleting Rollinson Channel project. This improvement was approved on June 17, 1954 by the House Public Works Committee.

The Belhaven Boat Basin extension into Wynne's Gut, although recommended by the Chief of Engineers in 1950, has not been acted upon by the Congress in view of some local differences of opinion as to the closing of East Front Street, necessitated by the proposed work. The request by local interests for the reconstruction of the existing timber breakwaters at the harbor entrance was not found to be economically justified by the engineer's review report.

CURRENT INVESTIGATIONS: In addition to the six projects listed above as having been recommended to the Congress for approval, and the several deferred projects undergoing study with a view to modification, there are a number of waterway improvements which are currently under investigation in accordance with Congressional directives.

Progress on these preliminary examinations and surveys has been slow due to severely restricted funds. During the 1954 fiscal year only \$1500 was allotted to carry on this work. This would have brought this program to a complete halt had it not been for a carry-over of about \$6400 from the previous fiscal year. Consequently the anticipated completion dates for most of these survey reports are highly indefinite. There are listed below the investigations, and their general scope, which have been assigned to the Wilmington District Engineer Office. Only navigation projects are listed and in all cases the date of completion is indefinite unless otherwise noted. Flood control and drainage studies are presented in Section XIII, RELATED WATER PROBLEMS.

Side channel to Elizabeth City via Albemarle Sound and Pasquotank River:- To determine advisability of providing channel so that small tankers and freighters sailing the Intracoastal Waterway could make deliveries to Elizabeth City. This study has been assigned to the Norfolk, Va. Engineer District).

Bogue Inlet and Swansboro Harbor:- To investigate the feasibility of providing navigation improvements in Bogue Inlet and Swansboro Harbor.

Cashie River:- To investigate the feasibility of providing an improved channel from the Thoroughfare to Albemarle Sound either by way of lower Cashie River, Middle River, and Bachelors Bay, or by any other route.

Middle Creek near Engelhard:- The type of improvement desired is undetermined pending the holding of a public hearing.

Cape Channel, Pamlico Sound:- To determine the advisability of providing a deeper channel from Pamlico Sound to Buxton.

Channel to Sealevel and Basin:- An investigation of the feasibility of enlarging and deepening the basin and side channel at Sealevel.

Harkers Point Basin:- To determine the feasibility of providing a boat basin either in the natural indentation at the west end of Harkers Island or along the south shore of the island.

Topsail Inlet:- The type of improvement desired is undetermined, pending the holding of a public hearing.

Carolina Beach:- To determine the advisability of improvements for navigation, pollution abatement, and commercial fishing. Preliminary examination report to be submitted in fiscal year 1955.

Holden Beach:- To determine the advisability of providing a boat basin at Holden Beach and improvements of Lockwoods Folly Inlet for navigation, principally commercial fishing, and prevention of beach erosion. Preliminary examination report to be submitted in August, 1954.

Shallotte River:- An investigation of requests for a deeper channel over the ocean bar and in the river.

CONCLUSION: The foregoing discussion leads to the inescapable conclusion that present, and possibly continued restrictions upon Federal river and harbor appropriations indicate that the completion of many worthwhile authorized projects will be delayed for several years, and that minimum maintenance needs on existing navigable channels will continue to be severely curtailed. If this situation is to be avoided it is obvious that supplementary funds must be made available from State or other local sources with or without the prospect of possible future reimbursement under the provisions of Section 11 of the River and Harbor Act of 1925.

XI. WATER TRANSPORTATION

In the preceeding Section, and Appendix A, brief descriptions were presented of North Carolina's vast system of inland waterways, with their interconnections via the Intracoastal Waterway to North and South Atlantic ports, to the State's own deep-water harbors and a hundred miles or more up numerous streams to interior communities. Many reaches are navigable in their natural state, and the Federal Government has added over 1,100 miles of improved channels, of which 41 can accomodate deep-draft ocean vessels.

Even though over 3,000,000 tons of shallow-draft, and about 5,000,000 tons of deep-draft commerce, is carried annually over these waterways a visit to them gives the impression that they are almost deserted except for an occasional tow or fishing boat. The question of "why," invariably intrudes. Neither is a simple, direct answer available nor are easily applied curative measures ready at hand. In that which follows some of the factors entering the problem will be discussed.

Two basic assumptions, and their corollary, have come to be rather widely accepted: first, that Eastern North Carolina, and its hinterlands, produce or consume millions of tons of commodities suitable for water transportation; second, this method of transport is cheaper than its competitive forms; therefore no reason exists why water-borne commerce should not increase greatly over present usage. Since this has not occurred, it is apparent that there must be interfering factors, or the above assumptions represent an over-simplification of the problem.

It is true that, in general, the actual cost of water transportation is considerably less than by rail or truck - but not always. In order to evaluate this differential and identify the exceptions it is necessary to discuss some factors which influence costs and their various components. By far the most important of these are the class or type of cargo, the volume or weight of the specific shipment involved, and the length of haul. Obviously, there would be no economy in trucking a few hundred pounds of freight to a water terminal, transfer and move it by barge 20 or even 100 miles, reload it and deliver it by truck to the consignee's warehouse. On the other hand tankers can move petroleum products half way round the world for less than it costs to ship them half way across the continent.

On the inland waterways it is again this bulk cargo where barge shipments show their greatest economies. Bulk cargo includes both liquid and solid materials which can be piped or dumped directly into the vessel's hold without containers or piece handling; these might be gasoline, oil, grains, coal, sand, gravel, ore, sulphur, scrap iron, oyster shells, nitrates and other bulk chemicals.

If handled in slings or heavy single units certain other commodities approach bulk cargo characteristics with respect to shipping costs as influenced by terminal operations. This class might include pulpwood, lumber, heavy pipe, tobacco in hogsheads, baled cotton, steel plate, structural shapes, and crates of barrels of uniform shape and weight. Any departure from homogeneity in the cargo handled at a particular mooring or on a single barge is immediately reflected in higher, overall shipping costs. Highest costs are encountered with a mixed cargo of pack-

aged freight of varying size and weight. These not only increase terminal handling difficulties with high labor charges but also adversely affect stowing efficiency in the vessel. These same cargo-type factors also have some influence upon the competing carriers using rail and highway; however, not to the same extent, since the transporting units - trucks or railroad cars - have capacities of from 10 to 80 tons as compared with 500 to 2000 or more for barges.

As between bulk and packaged cargo, this class or type factor may alone increase unit costs per ton-mile by 300 per cent or more for a 100 mile water haul and as much as 37 per cent for a 1000 mile haul. The relatively much greater effect upon the shorter haul is, of course, due to the high fixed handling charges being prorated against the lesser number of miles.

The second factor - volume or weight of the specific movement involved - has a greater bearing on unit costs than is generally suspected. In rail and highway transport practices distinction is made between less-than-carload or less-than-truckload movements and those which utilize (though not necessarily fill) a single vehicle. A similar cost factor is encountered in water transportation, except the equivalent tonnage would be that needed to provide an economical load for a barge of the type normally used in the movement - perhaps 200 to 1000 tons or more - as compared to a minimum of 10 tons for a truck and 30 tons for a railroad car. In water transportation very little, if any, bulk cargo is shipped in less-than-bargeload lots. In fact, the same generally applies to mixed or packaged cargo of uniform type; although these shipments were once the mainstay of the river packet boats they have all but disappeared in recent years from inland waterways.

With all three types of carriers unit costs and rates applicable to less-than-carload (or their equivalent) increase greatly as the weight of the shipment decreases. In fact it is probable that both the railroads and trucks take an actual loss on most shipments of less than 100 pounds. Above 500 pounds doubling the weight on these shipments may halve the unit cost on the shorter hauls. Based upon such limited data as are available indications are that these smaller, less-than-bargeload lots cost nearly three times as much per ton-mile as complete bargeload shipments.

The effect of terminal handling charges upon overall ton-mile costs become relatively less, of course, as the length of haul increases. For instance these unit costs might be twice as high for a 100 as for a 600 mile bulk-cargo haul and the effect is even more pronounced in the case of packaged freight. Although barge transportation for bulk cargo is cheaper than rail or truck for any length of haul, similar economies for packaged freight do not appear, when compared with truck to rail transportation costs, packaged-freight hauls must exceed 400 miles before the barge shows a favorable margin.

Important as they are, the above discussed three factors are by no means the only ones having a critical bearing upon shallow-draft transportation costs. The first of these concerns the efficiency of operating practices and the physical plant used. At one extreme we find the big Mississippi and Ohio River tows of 20 or more barges, each with a capacity of 1000 tons or more, and handled by a single

powerful towboat. The other extreme might be represented by a small self-propelled cargo vessel carrying a hundred tons or so of mixed freight between nearby ports. Ton-mile costs for the former might be less than one mill, whereas the latter could be a hundred times that amount. Waterway characteristics (depth, width, alignment and clearances) imposed restrictions which account for only a part of these widely varying efficiencies. In fact, on both the upper Mississippi, the Ohio and its tributaries, lockages are frequent and time consuming, necessitating the break-up of tows and their reassembly. Controlling depths are usually 12 feet, the same as provided on the Intracoastal Waterway and its main feeder channels. Present practice on local waterways is based upon usually one or two-barge tows. Pulpwood and grain barges are of about 500 to 750 tons capacity. The limited availability of tonnages at a particular time and place, as well as restricted channel dimensions, appear to dictate, in large measure, the tow make-up on local inland waters.

A completely balanced two-way haul, with favorable cargos carried as a back-haul, will nearly halve transportation unit costs for land and water carriers alike. Instances are not frequent where this profitable arrangement is possible on local waterways. Sometimes the type of barge required for one commodity is not adaptable to the only available return cargo. For example, oil barges are completely specialized; pulpwood and tobacco (in 1000 lb. hogsheads) are deck-loaded, whereas grain, and other loose bulk cargos, are carried in the holds. Also much of the floating plant now in use is designed and operated by a company to handle its own specific product or raw material, rather than as a common carrier.

For the common carrier it would appear that some promise exists in the use of bulk fertilizer as a back-haul for outbound Coastal Plain grain, if and when facilities are provided which would enable this grain to enter the export market through Wilmington from where some 15 fertilizer plants ship several hundred thousand tons annually to interior points. However, interviews with these companies have brought out some major objections to such a proposal. These were largely based on the seasonal aspect of fertilizer shipments (90 per cent during the interval December to April) and the difficulty of storage, bagging and farm delivery in the larger lots.

Based on present traffic common carriers transport but a very small percentage of the water-borne commerce, and with company-operated or contract carriers constituting the major movements - petroleum products, pulpwood, paper and grain - there does not seem to be much opportunity of increasing back-haul practices materially.

Another important factor affecting water transportation costs is that commonly referred to as "circuitry," or the extent by which water routes may have to deviate from more or less straight-line overland connections between terminals. In a few instances the water route may be less than by rail or highway, as is often the case in Eastern North Carolina where the indented coastline may lengthen the land routes considerably. However on most intracoastal movements some degree of circuitry is involved. River routes are particularly prone to meander, sometimes exceeding land routes by 50 per cent or more. The river distance from

Wilmington to Fayetteville is 115 miles as compared to 92 by highway. From Jacksonville, N. C. to Plymouth, N. C. it is 240 miles by the barge route as against 105 by rail.

In addition to the very direct effect of terminals, as discussed in Section XII, there are, obviously, many other secondary influences bearing upon water-transportation costs, but their individual effects are probably less than the unreliability and inaccuracies of available cost data. Also, in attempting to find reasons why inland waterway traffic has failed to develop as expected, we are much more concerned with comparative costs as related to all forms of transportation. Any evaluations of these competitive cost structures immediately introduce margins of error inherent in the equally unreliable data pertaining to rail and truck movements.

What is far more important, any analyses of the comparative economies to a shipper of the three conventional types of transportation, must be based upon rates as charged by a common carrier and not upon the latter's actual costs as experienced. Unfortunately, due to a wide variety of causes, but principally to a labyrinthian maze of governmentally imposed rate structures in all three fields, there is little or no valid relationship between the rates applied and the actual cost of the service involved for many traffic movements. The number of published rates - regional, class, joint, combined, export and other categories - which have at least some direct or indirect bearing upon inland waterway commerce in North Carolina, may well reach into the millions. What is more confusing, these rate structures are in a constant state of flux with changes announced almost daily on the average. The time and extraordinary detail required in making an analysis of comparatively limited scope, as to geographical area and commodity class, usually results in such a study being, in some aspects, obsolete before it is completed. Some commodity movements are extremely sensitive to relatively small rate differentials. A few cents change in freight charges on a ton of coal or a bushel of grain can, and have, set off rather violent regional repercussions.

Although there appears to be a trend in Federal rate making policy (Interstate Commerce Commission) to give more weight to cost-of-service factors, the basic concept is still one of maintaining or furthering competitive balances, both with respect to the type of carrier (water, rail and truck) as well as in interregional relationships. Almost any degree of artificiality in individual rates may be imposed or approved by the I. C. C. provided they cannot be shown to be unfair or unreasonable. As a result many instances occur where traffic moves, not by the least costly means (usually by water) but rather by a competing form with an I. C. C. approved rate which may net little or no profit to the carrier. Obviously, such lack of profit, or actual loss, must be counterbalanced by higher than average rates on other movements which are not subject to water competition. This is justified on the basis that railroads, being in a sense regulated monopolies, have an inherent right to a reasonable overall return on their capital investments. The unfortunate (from certain viewpoints) consequences are that commodities are not necessarily moved by the medium which can perform the service most efficiently and at least actual cost. Whether this regulatory interference with what seem to be basic economic laws promotes the general good, has been the subject

of countless studies, hearings, suits and voluminous reports. Many authorities have claimed for years that this policy, together with the whole structure of regional freight rates, serve as barriers to national, and particularly, Southern productiveness. Certainly, it can be shown that many inequities still exist with respect to some Southern industries, even though numerous adjustments have been made in recent years. In any case the infinitely complex factors which bear upon this whole question of comparative freight rates are far beyond the intended scope of this survey. The important consideration is that water transportation will not come fully into the role to which it appears entitled, until our entire transportation system is coordinated to the extent that the three classes of carriers are permitted, and encouraged, to give the type of service for which each is especially qualified and capable of performing at the lowest cost.

Common-carrier barge line rates applicable to our inland waterways are, of course, subject to I. C. C. jurisdiction, whether these be straight hauls or joint rail-water movements. On the other hand trucks moving farm and fishery products exclusively are not so regulated (Section 203 of the Interstate Commerce Act). Similarly, contract or company owned craft do not come under I. C. C. rate supervision.

Little reliable data applicable to actual waterway costs have been assembled. However, rather than the costs themselves the important consideration is that their relationship to equivalent costs of a competing transportation medium has much more influence upon the development of water-borne commerce. Some interesting comparisons have been obtained. Unfortunately the last really comprehensive investigation of this highly complex problem was completed in 1944, after a study of several years duration, by a corps of specialists. A report covering the survey was published as Senate Document No. 84, 79th Congress, 1st Session. Certain data has been extracted from that report and recast so as to illustrate basic relationships between the several factors bearing upon competitive rail, truck, and water transportation. Although actual costs applicable to all three media have increased considerably since the survey, it is not believed that their interrelationships have changed materially. It should be noted that costs and not rates are presented and that these include a reasonable return upon invested capital. Also, in the case of water movements the effect of "circuitry" has been included by increasing the actual length of haul by 50 per cent. Costs have been converted to a common basis of cents (or mills for the 100 to 1000 mile graphs) per ton-mile, for four types of movement.

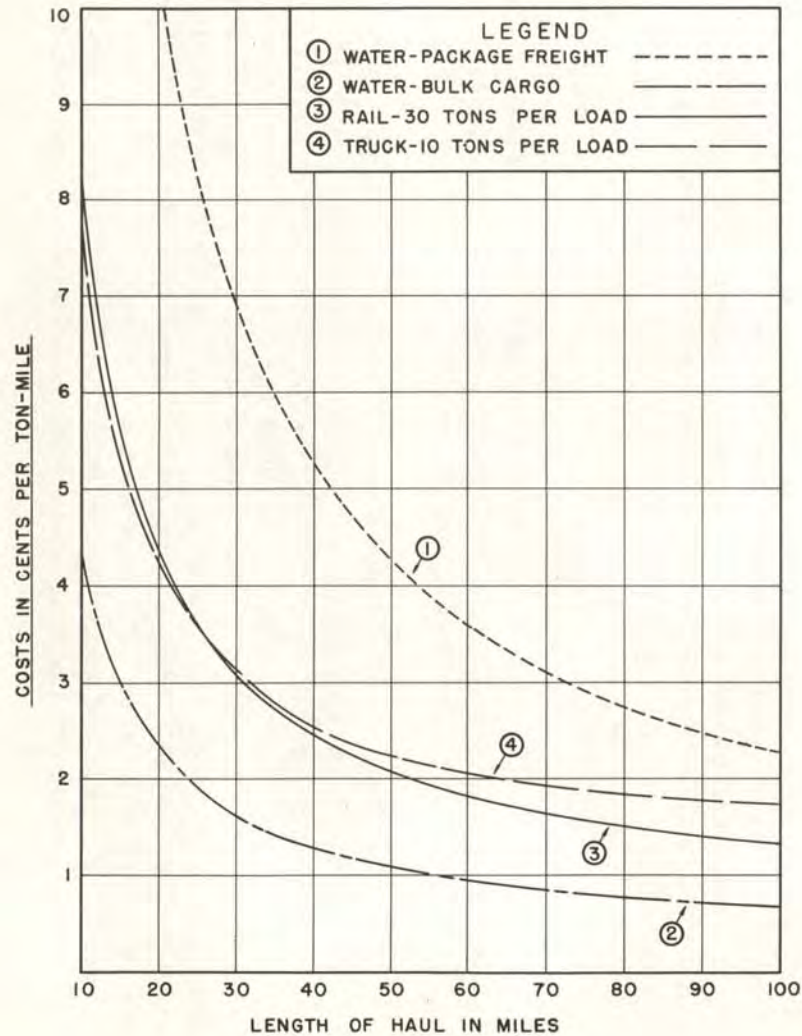
The data used is based upon Lower Mississippi Valley experience and therefore probably favors, somewhat, barge line costs as compared with those encountered in the less efficient small-tow practices used on North Carolina's inland waterways. On the other hand, on those few local movements of similar characteristics for which reliable information is available, the agreement is rather close. Analyses of the tabulated data below, and their graphical presentations (Chart XI-1) show the critical influence of terminal charges upon the shorter hauls by the various types of carriers. The intersections of the four curves are significant with respect to the relative economy for different lengths of haul. It will be noted that the vertical scale for the long hauls (100 to 1000 miles) has been increased great-

TYPICAL COMPARATIVE COSTS — RAIL, TRUCK, AND WATER

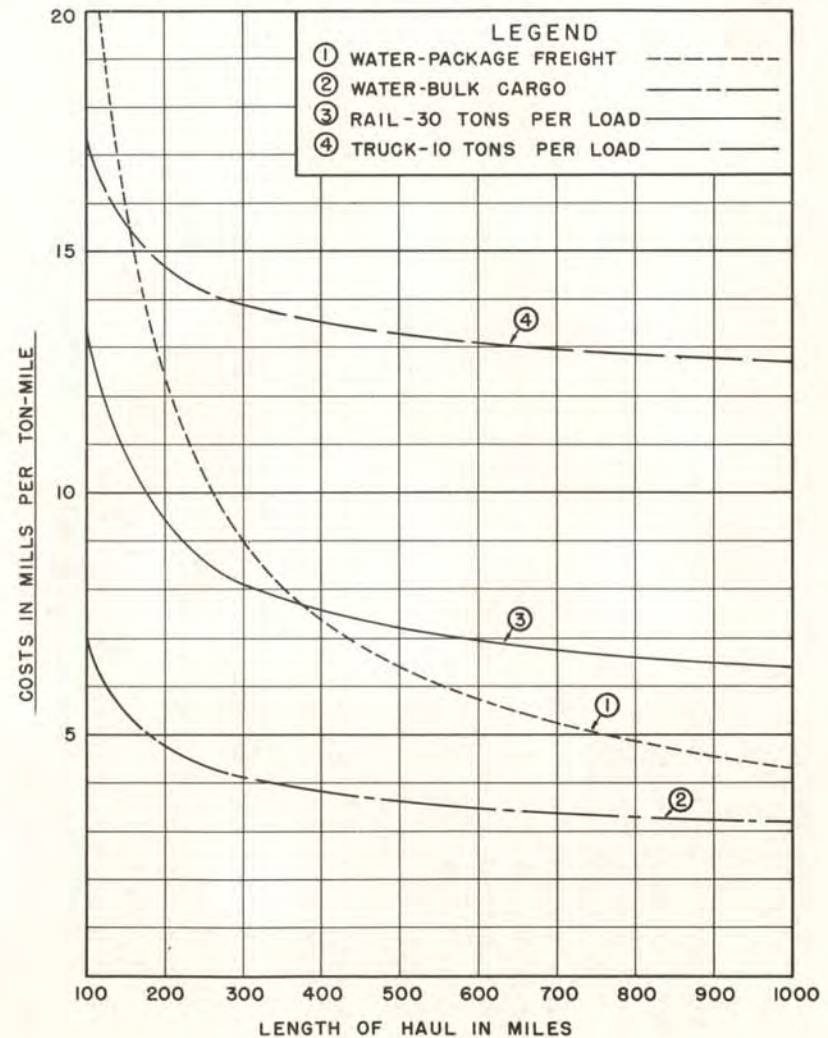
(SEE TEXT FOR QUALIFYING REMARKS)

CHART No XI-1

SHORT HAULS



LONG HAULS



ly (mills substituted for cents) so as to emphasize the rapid changes between 100 and 400 miles. It is important to note that all the listed cost, including packaged freight, apply only to car-load lots or their barge and truck equivalents. The minimum economical tonnage for a single barge will vary greatly with the size of the vessel and characteristics of the commodity and haul.

COST IN CENTS PER TON-MILE

(Car-load lots or equivalent)

MILES	WATER CARRIER (1)		RAILROAD (30 Tons per Load)	MOTOR TRUCK (10 Tons per Load)
	PACKAGE	BULK		
10	20.4	4.4	8.1	7.9
20	10.3	2.3	4.4	4.3
40	5.3	1.3	2.5	2.5
60	3.6	0.96	1.8	2.1
80	2.8	0.79	1.5	1.9
100	2.3	0.69	1.3	1.7
200	1.2	0.48	0.95	1.5
400	0.74	0.38	0.76	1.3
600	0.57	0.36	0.70	1.3
800	0.49	0.33	0.66	1.3
1000	0.44	0.32	0.65	1.27

- (1) Costs adjusted upwards to meet assumption mileage traversed is 50% longer than land routes.

It will be seen that bulk shipments cost less to transport by water than by land carriers for all distances. Over short distances package freight can be more economically transported by land than by water; however, over distances greater than 200 miles, even package freight costs less per ton-mile to transport by water than by truck or rail.

Analyses of the table and graphs reveal that fixed terminal charges have been included of about 40 cents per ton on bulk cargo and \$2.00 on packaged freight (one-half at each end). These were based upon actual costs with suitable adjustments made for taxes, return on the investment and overhead. It is probable that these terminal costs have increased at a somewhat higher rate since World War II than those items which comprise the line-haul totals. Stevedoring wage rates at Atlantic ports are at present about double those applicable to the Lower Mississippi Valley movements reported upon. At Baltimore and Philadelphia the rates vary from \$2.10 to \$2.58 an hour up to 5 P. M., with a 150 per cent premium rate after that hour. One carrier operating out of the above cities reports that stevedoring, warehousing, and other port charges amount to about 42 per cent of total earnings. This is not inconsistent with the quoted report which estimates terminal expenditures at about 45 per cent of total costs based on movements consisting of approximately 21 per cent bulk cargo.

Line-haul costs in the Mississippi studies were also based upon actual movements, but for various companies, which probably accounts for a somewhat higher rate (1.85 mills per ton-mile) being applied to bulk cargos as compared to package-freight hauls (1.54 mills per ton-mile). It should again be noted that all line-hauls have been increased by 50 per cent to compensate for the circuitry factor to make them comparable to land transportation.

Some cost data pertaining to eastern inland waterways have been collected which serve to measure the comparability of present experience here with the very elaborate analyses presented in the quoted report. Again, many variants intrude, but it appears that the line-haul cost of a thousand mile movement on the Intracoastal Waterway, involving barge-load lots of bulk or packaged freight, will be from about 1.75 mills per ton-mile upward. This rate is based upon a back-haul of about 30 per cent capacity of the returning barges.

For shorter one-way hauls of about 114 miles (Wilmington to Fayetteville) contract carriers of petroleum products receive about 6.5 mills per ton-mile, which, of course, includes profit, but is exclusive of the relatively low terminal costs, except those which result from stand-by time for the floating plant. The latter is restricted to a controlling depth of about 8 feet and three locks are encountered in transit. On the assumption that loading and discharge costs would be approximately the same for rail as by water, the line-haul rates (about four times greater by rail, but with a trip distance of only 85 miles) show savings of about 90 cents a ton in favor of the barge movement.

Another example of a one-way haul, using company-owned and operated floating plant is furnished by certain pulpwood movements of from 200 to 300 miles. Deck-loading of between 500 to 750 tons on from one to four barges per tow is the usual practice. It appears that the cost of this movement, including handling at highly mechanized terminals, is about 6 mills per ton-mile. Data as to the line-haul portion of this cost are not available.

On a 750 mile two-way movement over the Intracoastal Waterway, with packaged or bulk cargo and 25 to 75 per cent capacity of the barges utilized, line-haul costs, exclusive of depreciation and overhead, have been reported to be as high as 5.5 mills per ton-mile. However, competitive rail rates between the same cities (average of \$14 a ton for carload lots - \$22 for less-than-carload) permits of a fair margin of profit for both shipper and the common carrier barge line offering this service.

One barge line, which has in the recent past carried general cargo to a number of North Carolina inland ports has abandoned the service because of lack of business. Although this company provides service between Baltimore, Norfolk, and Charleston it has discontinued all stops at Coastal Plain ports. Evidently a combined truck-barge haul from northern cities in the Philadelphia and Baltimore area, by water to Norfolk and thence by truck to North Carolina points, has proven more profitable. The reverse procedure is followed with shipments originating in this State. Joint rates are offered which are from 10 to 20 per cent below all-rail tariffs. Full advantage is taken of mechanical handling equipment (pallets, fork lifts and tailgate-height covered aprons) at the three large terminals - Baltimore, Norfolk and Charleston.

Various types and combinations of floating plant are used by the companies plying the inland waterways. Tugs are diesel powered with from 300 or less horsepower to 1000 and over. At least one self-propelled barge of 3200 HP, but with only about 400 tons pay-load capacity, has been used. This type of carrier does not appear to be effective on the longer hauls but might prove more adaptable to short feeder service or as a contract carrier for special cargos. Barges are of numerous sizes and types with some Navy craft (LSM) converted to decked barges. South of Norfolk tows are usually pushed rather than towed on a line if weather in the open sounds permits.

COMBINED SEA-LAND OPERATIONS: There is at present an application before the Interstate Commerce Commission for permission to establish a so-called "SEA-LAND" combination service whereby loaded trailers would be transported by ocean-going vessels from North Atlantic ports to southern coastal cities. This application was submitted by the McLean Trucking Company of Winston-Salem and according to advance information it involves construction of four specially designed 600-foot vessels costing over five and a half million dollars each and capable of carrying some 240 loaded trailers at 20 knots. It is understood that either Wilmington or Southport are being considered as a port of call. Terminal facilities would be provided so that power units could load or discharge the trailers in an estimated time of four hours as compared to conventional methods requiring some 60 hours for an equivalent pay load of 3500 tons.

There are many promising aspects to this proposal. It is patently a step toward utilizing the inherent advantages of both the low ton-mile cost of water transportation and the flexibility, including door-to-door short-haul delivery, of the truck. The most serious handicap of water transportation - high terminal cost, usually involving extra handling - would be very materially reduced. Since sea-land terminals could be located outside the more congested metropolitan areas the rapidly mounting traffic concentrations through these centers could be largely by-passed. Areas of potential tonnage at considerable distance inland could be tapped by strategically located terminals with access to arterial highways. The rising incidence of labor troubles and the heavy toll of cargo pilferage at the larger ports could be reduced or eliminated. Lost time in port would be considerably reduced.

The proposed service would be similar in some ways to the sea-train (railroad cars on ocean-going ferries) now plying between Florida and Cuba, or the "Piggy-Back" method of transporting loaded trailers on standard, or specially designed flatcars.

Some years ago a very similar service was established between New York and Albany but it was not successful and was later abandoned. Among the causes claimed for the failure was the unsuitability of the floating equipment used and the "feather-bedding" demands of union truck drivers whereby (it is reported) they were to be paid full rates, plus hotel accommodations, for 24 hours while awaiting a return trailer from Albany. The McLean Company claims that these demands will not be repeated by the teamsters' union in the proposed operation.

There are, of course, some adverse considerations. First, the question arises as to how much of a premium rate shippers will pay, and Interstate Commerce Commission approve for the expedited waterway portion of the trip. It is planned to make the run from the New York area to the North Carolina terminus in about 30 hours. The net pay load per trip would be 3500 tons or the equivalent capacity of about four medium sized barges in two tows. The capital investment for this shallow-draft equipment (2 tugs and 4 barges) would be less than one-tenth that reported for one sea-land vessel. Undoubtedly a good part of this disparity would be offset by greatly reduced handling costs in the sea-land operation. The remainder would have to be counter-balanced in some manner by the advantages of expedited movement.

The above rough comparisons intrude the question as to whether this same sea-land approach could be successfully adapted to a trailer-barge operation, substituting the slower - and less expensive - shallow-draft carrier for the ocean-going vessel. Barges of 36 by 175 feet would carry about 20 trailers with some 300 net tons of pay-load. Trip time would be from three to four times that required by the faster unit. Neglecting the effect this slower turn-around time might have upon operating costs the question arises as to whether there may not be concurrent operating advantages in the assembly and dispatch of 20-trailer groups as compared to units of 240 trailers. It is possible that the smaller barge groups could be dispatched as they are assembled rather than upon a scheduled basis inherently necessary in the ocean-going service. This practice should reduce the percentage of below-capacity shipments.

It is understood that the McLean organization, as well as others, have been investigating the economies of such a trailer-barge adaptation. If it could be worked out as a profitable operation whereby these two transportation media could individually and in combination, assume the roles for which they are so well fitted, the effect upon Eastern North Carolina's economy might well be of considerable importance. Presumably this would be set up as a common-carrier service and participation by local or higher governmental bodies would be limited to some degree of assistance in providing a suitable trailer-barge terminal.

Considerable opposition to the McLean application has developed, as well as differing opinions with respect to the economies involved. It is pointed out that pilot fees alone (estimated at \$1000 per call at Wilmington) would be prohibitive. Perhaps the fact that competing carriers - rail, water and truck - appear to be vigorously opposing this application may suggest it has promise of success and therefore a threat to these interests. In addition to operators it is reported that certain unions, particularly longshoremen, if not truck drivers, are among the complainants. The opposition claims, in part, that the applicant seeks to acquire a waterway franchise, paramount to a monopoly, which would parallel his own truck routes, contrary to law and Interstate Commerce Commission policy. Regardless as to whether competing truck lines would be accommodated on an equal basis with the applicants' trailers, the possibility of discrimination is suggested. Perhaps an organization entirely independent of an established truck line, which would provide service to all comers, at uniform rates, is a practical solution.

In any case it appears that the sea-land idea, because of fundamental merit, is reasonably sure of being established in one form or another in the not too distant future. Perhaps there is less likelihood that the trailer-barge adaptation can be developed successfully; however, there are a number of factors now operative in the transportation field which tend to increase the advantages and lessen the penalties applicable to both proposals. Also, the idea has National defense implications as indicated by the fact that the Army Transportation Corps is at present studying the practicability of using the carriers as reserve units to their military transport fleet.

An objection once often cited against slow barge movements is that they tied up, unduly, capital represented by the value of these in-transit cargos. Large scale shippers have offset this objection, particularly on the longer hauls, by using the carriers, in a sense, as mobile warehouses. For instance, a shipment of steel pipe is started down the Ohio-Mississippi system from Pittsburgh but without fixing a definite consignee or destination. These are determined days later by the time the tow is well along on the trip, when a full or part of a barge-load is dropped off at a specified port. Under favorable circumstances similar practices might be adapted to Intracoastal Waterway movements; however, it is doubtful that presently available tonnages would lend themselves to this procedure.

In conclusion it would appear that the innumerable complex factors which bear upon comparative land and water costs and rates have created definite economic barriers to expansion in the near future of general cargo or packaged freight movements which involve relatively short hauls to or from Eastern North Carolina shallow-draft ports. Country-wide experience seems to support such a conclusion. Barge line officials who are successfully transporting such cargos over the longer Intracoastal Waterway routes have, without exception, expressed the same conviction. Their common reaction is that the development of this type of traffic must await further industrial expansion, and the increased tonnages it will produce in the Coastal Plain and its immediate hinterlands. It is true that at least some of these officials have expressed the opinion that increased channel depths, with full 12 feet or more assured at all times, would greatly encourage water-borne commerce of all types. This may be, in part, true; however, experience based upon the vast Ohio-Mississippi system tends to minimize the importance of these restrictions. The entire Ohio River as well as the upper Mississippi have project depths of only 9 feet. Although the lower Mississippi, down to Baton Rouge, has a 12-foot project depth the controlling depth is only 9 feet. Yet in spite of this, it is reported that Memphis, Tennessee is constructing a \$45,000,000 municipal terminal.

The extent to which long established policies and rate regulations of the Interstate Commerce Commission are hampering the expansion of water-borne commerce is difficult to evaluate. Many transportation experts claim that these are major obstacles to progress. Some support to this contention may be found in the fact that it is the unregulated contract and company-owned carriers which are proving so successful on our inland waterways. Of course, these movements are mostly of bulk cargos or their near equivalents (e. g. , pulpwood). Even grain traffic is carried from North Carolina ports by company-owned or operated plant.

It would appear that private enterprise is usually sufficiently susceptible to potential profit inducements to the extent that promising ventures are soon developed. Assured profits are found with bulk movements and the necessary facilities to handle them are usually supplied by corporate management not too long after their need and the accompanying profits are recognized. It would not appear wise for governmental agencies to enter precipitately the much less promising field of general cargo or packaged freight commerce, even to the extent of participating in the development of terminals, until a thorough and realistic analysis of all factors having a bearing upon its success has been made.

In the meantime any build-up of industrial, and other tonnage-producing activities in the coastal areas, will bring the day that much closer when water-borne movements of other than the more favorable commodities, usually carried as bulk cargo, may be profitably developed.

XII. PORT TERMINAL FACILITIES

INTRODUCTION: The many and varied types of shallow-draft terminals in the Coastal Plain area perform an indispensable role in its waterway system, affecting the regional economy by their influence on the availability and efficiency of water transportation. The size, type, and location of these terminal facilities are determined, in large part, by the demands of water-borne commerce, together with such conditioning factors as relative costs, the physical characteristics of the navigable channels themselves, and the contiguous land areas served.

The availability and proper functioning of these ports is a prerequisite to both the further development, and the continuance of existing commerce on the inland waterways. Although adequate terminal facilities will by no means insure the expansion of this mode of transportation, under otherwise favorable conditions, traffic on navigable waters, and economic progress in surrounding areas, may be encouraged by such installations.

A complete listing and detailed description of all port terminals and allied facilities in the State is beyond the scope of this report. In that which follows, some representative installations of the more prevalent types are described and a number of instances are cited where there appears to be particular significance with regard to further development; finally, some aspects of the feasibility of public terminal projects on the inland waterways are discussed.

TERMINAL CLASSIFICATION: Port terminals in the Coastal Plain area can be grouped in five general categories with respect to the type of vessel served or the nature of cargo handled. Among barge loading installations, a distinction is made between the terminals that handle bulk materials and those that are equipped for general cargo, either mixed or uniform and packaged. As a third type of port there are marinas, which serve recreational craft only; a fourth group consists of installations for commercial fisheries, and finally there are the two deep water ports at Wilmington and Morehead City.

Numerous bulk handling facilities are found along the inland waterways of the State, since fuel, raw materials and other bulk cargo are well suited to barge transportation. Some materials have the added advantage of requiring but minor construction and small capital investments for cargo handling equipment. All of these installations are owned and operated by private firms, and each is adapted to the specific requirements of the particular movement and commodity involved. Although noteworthy from the viewpoint of total tonnages moved, these terminals, operated and expanded as necessary to meet the requirements of corporate enterprise, enter only incidentally in the present survey on the assumption that industry is fully capable of evaluating expansion needs. An important contribution of these terminals is that the large tonnages of petroleum products, pulpwood, grain, chemicals and similar bulk cargo constitute the major justification for continuing Federal maintenance of the inland navigable waters over which they move.

General cargo terminals are in existence at various locations in the Coastal Plain area, even though water-borne shipments of packaged freight requiring

piece handling have been greatly reduced. The experience gained at these terminals must be considered in any planning of future developments. Marinas have become of growing importance with the tremendous increase in pleasure craft ownership during the last ten years; along the Intracoastal Waterway, a number of these have already been developed. Fisheries, one of the oldest industries along the coast, operate many installations in the area from simple piers to large scale terminals; in a number of cases, allied industrial facilities are located at or near these terminals.

Wilmington and Morehead City, the two developed deep-water ports of the State, affect the economy of areas extending far beyond the limits of the Coastal Plain. Locally, in addition to the assets they represent to industry and commerce in their immediate vicinity, they are also of potential significance as transfer points for the inland waterways. In the following, the installations at these ports will be discussed only within the framework of the above mentioned four classifications. For more detailed information pertaining specifically to the facilities at Wilmington and Morehead City, reference is made to "Port Series No. 12," published by the Corps of Engineers, Department of the Army, and the Maritime Administration, U. S. Department of Commerce.

LIQUID CARGO TERMINALS: The most extensive use of all navigable waterways in the Coastal Plain area is being made by the various oil companies that have distribution centers of marine service stations at many localities accessible to barge transportation. In the upper reaches of some of the rivers, for instance at Fayetteville on the Cape Fear and at Murfreesboro on the Meherrin, oil barges are at present the only craft making regular shipments to the head of navigation.

Oil and other liquid cargo terminals are of very simple construction, usually comprising several clusters of timber or steel piles for mooring the vessel, a planked walkway from the shore for personnel access, and hose connections at the outshore end of the walkway. Some terminals have a small boom with block and tackle for handling the flexible hose that is extended from the barge. On the land, pumps and storage tanks with distribution piping and loading points for railroad cars and trucks, all of which represent the major portion of invested capital, are in general conformity with standard practices of the operating companies for inland locations. Where terminals are located on waterways which are subject to high flood stages, such as encountered at Fayetteville, (50 feet or more above normal pool) alternate hose connections are provided at several different elevations along the discharge line leading up the sloping river bank.

Marine service stations are similar in construction to other oil loading docks, except for the addition of a metering pump at the head of the walkway. In many cases, however, these stations operate on docks that are used for other purposes as well, the metering pump being mounted on a fishing or marina pier, so that separate mooring facilities are not required.

The many terminals of this type in operation at the present time handle fuel oil, gasoline, asphalt and other petroleum products, which amounted to approximately 40 per cent of the total tonnage transported on the inland waterways in 1951.

They are being kept in excellent repair and their further development by the oil companies can be expected to keep pace with the growing demand in the area.

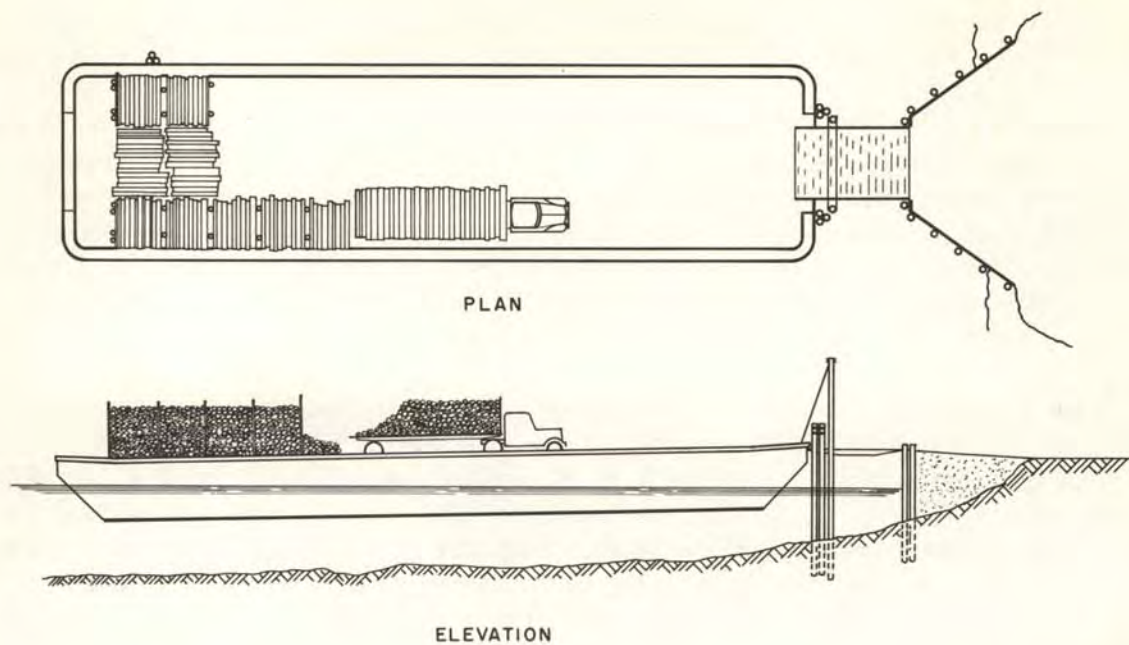
PULPWOOD INSTALLATIONS: The vast amount of logging being done throughout the Coastal Plain area makes pulpwood the most important local product that is at present transported by barge. There are many wood storage yards and loading facilities along the shores of rivers and sounds in the State. Some of these are of a makeshift character, being installed near timber tracts which are under active logging operation at the present time; others are more elaborate and constitute a sizable investment at a permanent location.

A representative case of the simpler types of pulpwood loading operations is illustrated by Type A of Plate No. 8. With this method, trucks are driven onto the barge and unloaded by hand. It is reported that, during favorable weather permitting uninterrupted logging operations, such an installation can load one barge to 250 cords (approximately 675 tons) in about one week. Similar construction is sometimes used in conjunction with a mobile crane which operates either on the barge or from the shore, whereby manual labor and loading time can be greatly reduced. The use of slings is common; however, some facilities were found to be using cranes equipped with grab devices.

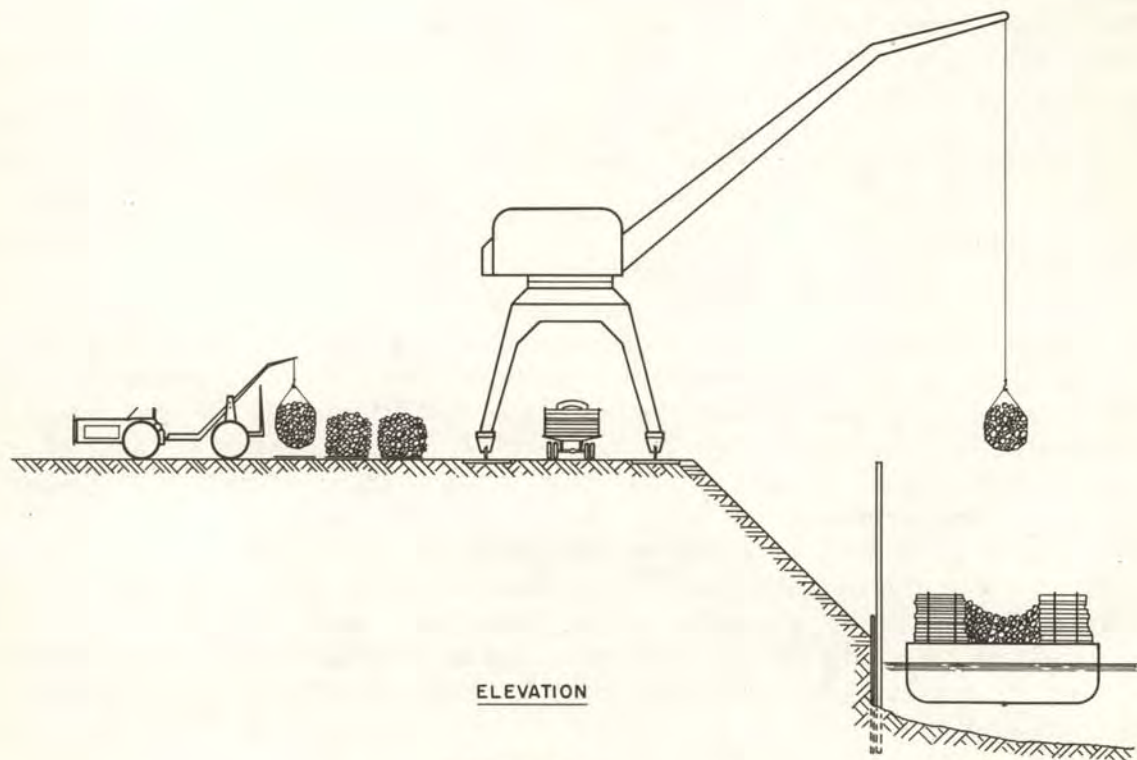
The pulpwood loading installation of the International Paper Company at Elizabethtown is one of the most efficient and elaborate of those observed. As the Cape Fear River is subject to extreme high water conditions in that area, the yard was placed on the river bank some 30 feet above normal water elevation. An electrically operated gantry crane, running on rails parallel to the river, is capable of loading one barge (225 to 250 cords) on the average, within one 8-hour day, using slings of three to four cords. A Tournapull crane handles yard storage. Prior to depositing a load in the yard, the pulpwood is tied with a steel band in order to facilitate future pickup by sling. A schematic drawing of this installation is shown as Type B of Plate No. 8.

The size and consequent cost of pulpwood loading installations are determined primarily by the length of time they are expected to be in operation and the quantity of material to be handled during this period. Both factors are dependent upon the availability of timber within a certain radius, usually limited to about 45 miles by truck; for long term operations, this may involve the consideration of regrowth in the area. Since the cost of pulpwood at the yard increases approximately 8% for every increment of 15 miles of trucking distance, the relative economy of various methods and the extent to which facilities at a given site should be developed can be evaluated. The large and more permanent operations were reported to require investments of two to three hundred thousand dollars; smaller installations of the kind illustrated by Type A may vary between about five and thirty-thousand dollars, depending in part on the amount of dredging necessary at the location.

Despite the fact that there has been a decline in barge shipments of pulpwood and timber over some of the coastal waterways, these industries, on the whole, are making excellent use of waterway transportation, with the prospect that suitable loading facilities will be installed as additional forest tracts are brought into



TYPE-A



TYPE-B

TYPICAL PULPWOOD LOADING INSTALLATIONS

production. Such decline as did take place, was not caused by factors attributable to either the waterways or the terminal facilities as they now exist, but rather to gradual shifts in timber availability.

GRAIN LOADING TERMINALS: Water-borne traffic is not being used extensively for the transportation of the agricultural products of the State. Grain, the farm commodity best suited for bulk cargo, is loaded into barges at only a small number of the terminals operating at the present time.

At Belhaven and Engelhard, grain elevators are located near the waterfront and barges can be loaded by chutes that incline from the top of the structure to an elevated support near the bulkhead line. A movable extension, suspended at this support, allows some flexibility of the discharge point; but this is usually not sufficient to avoid having to move the barge when loading is shifted to a different hatch. At Washington, the grain storage bins are located a considerable distance from the shore; it is reported that this was done in order to avoid the expense of pile foundations. Grain from this installation is trucked through the streets of the town to a free-standing bucket elevator on the waterfront. A chute arrangement, similar to that described above, discharges the grain into the hold of the vessel.

Grain loading facilities appear to be one type of bulk loading installation that has not kept pace with existing potentialities for better utilization of the inland waterways. There is a steadily increasing supply of grain in the area suitable for export or domestic use in adjacent areas (e. g. eastern Maryland) and which have shallow-draft waterway connections with Coastal Plain points. Although some grain is shipped out by water from the latter, it is believed that these movements can and will be materially increased as suitable handling facilities are provided at both originating and receiving terminals. With respect to the latter, at the present time, the Port of Baltimore is the nearest point having such barge unloading facilities. Another significant deterrent to the development of such grain loading facilities seems to be a reluctance to build elevators near the water where foundation difficulties may be encountered. It is pertinent, in this connection, to point out that the cost of pile foundations is frequently very much over rated. In many locations where sandy ground is encountered, piles may not be necessary, and in areas where sub-surface conditions do not allow spread footings or mats, pile foundations can be installed at an estimated increase in the cost of the entire project of six to eleven per cent for the larger reinforced concrete grain elevators. It may also be mentioned that a type of tank construction which will meet Commodity Credit Corporation prescribed standards can be recommended so that the elevator may qualify for this type of government storage if and when desired. Such auxillary use might produce an additional guaranteed return as well as provide better performance and margins of safety.

CHEMICALS, AGGREGATES AND SPECIAL COMMODITY LOADING: Sand, gravel and chemical materials constitute only a small percentage of the water-borne tonnage moving to and from terminals in the Coastal Plain area. Aggregates seldom require permanent loading installations, because they are, in most cases, connected with construction projects of limited duration. Permanent unloading facilities for chemicals are in existence at several plants along the inland

waterways. Since no sanitary requirements are involved in the handling of most of these bulk materials, cranes with grab buckets are commonly used. Such terminals as the fertilizer plant at Williamston require only a few piles for mooring the barge, provided the crane boom is of sufficient length to reach over a water area of adequate depth.

An example demonstrating efficient handling of a special commodity is found at the Plymouth plant of the North Carolina Pulp Company. This mill has a paper storage warehouse located adjacent to the bulkhead along the river; the roof of this warehouse, together with the rails of an electric bridge crane running beneath it, are extended beyond the bulkhead to a supporting structure in the river. A 2,000-ton capacity barge can be moored between the bulkhead and the outer support. This permits the loading of a barge within eight to twelve hours, in an area protected from the weather and utilizing the same crane that handles the large rolls of finished paper within the warehouse.

Inasmuch as facilities for handling such materials are almost always directly connected with manufacturing or processing plants, their development can be expected to go hand in hand with the progress of industrialization in the area. Although improvements may be devised, it is probable that future construction will follow generally along the lines of existing installations of this type.

GENERAL CARGO TERMINALS: The shipments of packaged freight referred to as general cargo, particularly of the mixed type, have been on the decline for a long period of time in the field of shallow-draft transportation. This trend is by no means confined to waterways within North Carolina but is common experience throughout the country. Existing port terminals in the Coastal Plain area have been greatly affected by this decline. Some contributing factors have been discussed in other sections of this report. Local distributors, the recipients of most general cargo shipments, with modern transportation facilities, can meet their demands by ordering on a much shorter time basis than in the early days of waterway traffic. With assured prompt deliveries they can materially reduce storage requirements and escape excessive capital charges for large stock inventories. Suppliers have geared their operations to these practices. Highway and rail lines are now transporting most of this cargo, but not solely for reasons of speed. The rising cost of terminal operation, particularly the labor item, has contributed largely to a reduction in the relative economy of water transportation as compared to other forms. Also, regardless of the efficiency of the terminal, these transfers usually represent an extra handling, the cost of which grows in importance as the length of the water-haul is shortened. If, in addition to these general conditions, the volume handled through a terminal is so small and the intervals between shipments so long or irregular that an efficient operation becomes impossible, even with the best of organization, water transportation may lose completely its competitive transportation cost advantage over other forms of transport.

Many instances can be cited, in this and other states, which tend to support the above observations. Several general cargo terminals along the navigable waterways of North Carolina have not been successful, with most of them now inactive or converted to other purposes. Consideration of the experience gained

with these installations and the factors contributing to their lack of success, should not be ignored in exploring the possibilities of proposed future ventures. One example of a general cargo terminal recently built is near Greenville in Pitt County. The Tar River Port Commission was formed in 1938 for the purpose of constructing and operating installations connected with barge traffic in the area. Dredging was completed by the Federal Government in 1939, providing a 12-foot channel from Washington, N. C., and the lower Pamlico, to a turning basin at Hardee Creek, about 3 miles below Greenville on the Tar River. A warehouse was erected at the turning basin with a covered ramp connection to mooring dolphins located a short distance offshore. This installation was in operation from 1940 to 1942, being supplied regularly by shipments of the Norfolk-Baltimore and Carolina Line. During the first five months of the operation, reported receipts averaged about 280 tons per week and consisted of mixed general cargo. Outgoing shipments, primarily of tobacco, amounted to an average of less than 100 tons per week. In later movements to this point incoming cargo was reported to be in the neighborhood of 600 tons per week; no data on the total outgoing tonnage over the two year interval are available. In 1942 shipments to Greenville stopped, allegedly due to war conditions and the commandeering of the N. B. C. Line boats by the Navy. They were not resumed after the war, even though shoaling in the amount of nearly 300,000 cubic yards was removed in 1946 from the 18-mile channel above Washington by maintenance dredging at a Federal cost of about \$75,000. This was based upon hopes that traffic would be resumed. Officials of the line once serving this port have stated they would not reestablish this service regardless of what facilities were added at Greenville.

To date, approximately one half million dollars has been spent to make shipments to Greenville possible; over 90 per cent of which was expended by the U. S. Government for the initial dredging of the channel and turning basin and their later maintenance. The remainder was spent by the State for highway connections and by the Tar River Port Commission for the terminal. At the present time, the 16,000 square feet of floor space in the building is used for tobacco storage.

The possibility of future water-borne traffic between this port and other terminals appears to be contingent upon the development of large scale movements of special commodities such as tobacco and grain, which are grown in considerable quantity in the surrounding area, with, perhaps, a suitable back-haul of fertilizer or other materials. In any case, additional facilities would have to be provided at this terminal if grain dealers, or industries which could adapt their operations to barge transportation in part, are to be attracted. It will also be necessary to convince the Federal Government that sufficient commerce is in prospect to warrant again bringing this 18-mile waterway back to project depth of 12 feet, with perhaps a continuing annual expenditure of from \$25,000 to \$50,000 for maintenance. The prospects of successfully revitalizing the shipments of general mixed cargo through this terminal do not appear promising.

Another terminal designed originally to handle general cargo is located at Fayetteville, where the Cape Fear River is at present navigable and in constant use by oil barges and recreational craft. The installation was erected in 1934 for a reported cost of \$87,500, including a warehouse of 5,000 square feet floor area,

a loading apron, a crane at the dock, and rail connections. Due to flood threat these shore installations are some 40 or 50 feet above the low water stage of the river as fixed by Lock and Dam No. 3, about 20 miles downstream. Another building with 4,500 square feet of storage space has been added since the original construction of the terminal and both warehouses are at present leased to private firms for storage purposes. The facilities are not being used for barge loading and no record of recent waterway shipments to this installation has been found. It appears unlikely that general cargo movements through this point will be developed. Provision of this public terminal was a prerequisite of local cooperation imposed by the Corps of Engineers and conditioned the recommendation to Congress for approval of the Cape Fear River navigation project.

Similar requirements for local cooperation to the extent of providing a public terminal as a requisite to the Federal adoption of a waterway project have been imposed at several points on the inland waterways. The Fayetteville experience has been more or less duplicated at some of these ports (e. g., Belhaven). There are a number of other localities in the Coastal Plain that have municipal wharves and private piers for handling general cargo. The town of Williamston, for instance, has a warehouse and mooring facilities both of which are in very bad repair and not in use, even though the Roanoke River is navigable to this point. Many towns like Washington and Elizabeth City, just to mention two random examples, have waterfront properties with mooring facilities where general mixed cargo loading is physically possible but is not being practiced.

In view of the cases cited above and their representative nature for other installations of this kind, there seems to be little promise in the future development of such terminals to serve general cargo, particularly of the mixed type. It would seem that, for this reason, any proposal for a large scale public terminal project, if such be undertaken, should assign a low priority to warehouse and loading facilities for general or special packaged freight unless an industrial or shipping concern contracts in advance for sufficient services to justify the cost of such installations.

MARINAS: The word marina, coined some years ago by the National Association of Engine and Boat Manufacturers, is applied to the modern boat basin with facilities for berthing all types of recreational craft, as well as providing adequate supplies, provisions, service and means for fueling. Although sometimes used to describe such limited facilities as a single finger pier with a gas pump on the end, ordinarily it infers some or all of the following appurtenances.

- a. Berthing slips with mooring facilities including access walkways, either covered or open.
- b. Fueling stations.
- c. Water and electric outlets at the slips.
- d. Repair shops, marine railway and spare parts.
- e. Toilets, showers, telephone, garbage disposal, ice.
- f. Stores, shops, restaurant, lounge or club.
- g. Theatre, playgrounds or other recreational facilities.
- h. Landscaping, parking lot or waterfront park.
- i. Adequate personnel to man facilities and service the craft.

One of the most phenomenal expansions since World War II has been that of the pleasure craft industry, sales having more than doubled during the post war period. In January, 1953 LIFE magazine reported that boating was dollar-wise, America's most important recreation. Even then there was one boat for every 32 persons in the United States or about five million craft if the smallest types are included. The provision of moorings, slips and storage space has lagged far behind this trend. It was estimated that their number could be doubled without meeting the demand. In many cities boat dealers cannot sell cruisers unless they can provide a slip for the purchaser. The past year has seen this increase accentuated throughout the country with similar reports coming from the coastal areas of North Carolina.

In 1951 there were about 2400 documented (5 net registered tons or larger) craft in North Carolina; more recent data are unavailable. In addition, it was reported (address by Bert Robb, Director of Michigan State Waterways Commission, to Department of Conservation and Development meeting at Morehead City, July 28, 1954) that there were 8,932 smaller boats registered in the State. From the same source information was obtained that there are about 5000 transient craft from other states that travel through the coastal waterways. Attempts to verify the latter figure indicate that it is considerably high. The 1953 total of north and south bound pleasure craft passing Carolina Beach draw span was 2295 and this may have included some local vessels. However, there is a definite upward trend in this traffic, with a 23 per cent increase since 1950.

The heaviest south bound traffic occurs in October and November and north bound in April and May, with three and four hundred passages in a single month. Most of the smaller boats use the Dismal Swamp route and following the Intracoastal Waterway they have marina or similar services available at Elizabeth City, Belhaven, Hobucken, Morehead City, Beaufort, Swansboro, Wrightsville, Carolina Beach, Wilmington and Southport. The long intervening stretches between these points offer little in the way of service to the through-bound yachtsman. There are a few marinas or small boat basins at other points off the Intracoastal Waterway such as New Bern, Hatteras, Ocracoke and with minimum facilities at Manteo, Oriental and other locations.

There is a real need for additional installations and expanded services throughout the area. The marina, whether of municipal or private ownership, needs the support of the community, and its success in attracting the transient boatman's trade might be of considerable importance to the smaller towns. In view of this community interest and the possibility of combining marina facilities with other waterfront improvements it may be found advisable for the town to finance and construct the entire project and lease all or part of the installation to private management. This practice has been followed successfully in many cities with the inclusion of some outstanding waterfront beautification programs. Both transients and local craft may be accommodated with expansion geared to demand. Whether the marina is privately or municipally owned and operated adequate capital is a prerequisite if the project is to be carried successfully through the initial development period. In some instances marinas have been financed by a yacht club and later expanded to serve the transient boatman. In any case the construction and

operation of a marina is a specialized business and careful planning is of vital importance if costly mistakes or even failures are to be avoided.

There is also need for more small basins or harbors of refuge. Although the inland waters are in a sense protected, some of the longer open reaches can become hazardous for small fishing and pleasure craft during a severe blow from certain directions. A study in considerable detail would be required to locate needed and suitable sites for these small boat harbors but their lack has been frequently commented upon by boatmen plying the longer stretches of these waters. Meeting this problem in at least a few of the more critical locations may be found feasible without excessive expenditures. Some protected areas are already available though they may have difficult approaches dangerous to the stranger. In many cases these approaches could be materially improved with a nominal amount of dredging.

The entire field of pleasure craft facilities is highly important to the future development of Eastern North Carolina and could well be made the subject of a separate and detailed investigation. Such a study would have to be coordinated with the National Park Service in the latter's plans for the Cape Hatteras National Seashore Recreational area.

FISHERY INSTALLATIONS: The fishery industries, discussed in Section VI of this report, are of considerable importance to many small communities in the Coastal Plain, even though most of the shore facilities consist of relatively simple structures representing only a minimum of capital investment.

The major problems faced by the fishermen at a considerable number of their ports are a lack of protection from the sea and insufficient depths of water. Some of the most important fishing centers on the sounds, for example the towns of Oriental, Belhaven, and, to a lesser degree, Atlantic, do not afford adequate shelter for boats moored or anchored in their basins. Damages are often caused by wave action from an unfavorable direction. Corrective measures such as the construction of breakwaters or the extension of the basins further inland are often impracticable as Federal projects and might be excessively expensive. The problem of restricted depths exists, both within the limits of Federally maintained channels and adjacent to fishing terminals so that movements of many of the deeper draft vessels are severely hampered. Menhaden boats in particular, when fully loaded, frequently go aground while approaching or maneuvering in such channels at Taylors Creek (Beaufort Harbor).

Inside the fishing ports, the docks, moorings and other structures are mostly of simple timber construction and appear to serve satisfactorily, though a shortage of wharfage space and the need for repairs is evident in numerous instances. The buildings at these piers, where fishery products are transferred, sold or processed, are not elaborate in nature and frequently give the impression of congested operating conditions.

Many of the communities that are at present interested primarily in the fishing industry, are well suited for the development of marinas and other recreation-

al activities to supplement their present local economies. However, if such a development is to occur a general refurbishing of waterfront installations would be most helpful, and in fact necessary where unsanitary accumulations of fish refuse and oyster shells have occurred with concurrent befoulment of harbor waters. Without large expenditures, a great deal could be accomplished: piling and sheds of abandoned docks could be removed; minor repairs and new timber curbs along the edges of piers that are still in use would enhance their looks substantially; some painting of the buildings could be afforded, with only a small additional cost for some colorful trim; unused waterfront lots could be seeded and the planting of a few shrubs and trees would contribute materially.

Town or village governments could bring about many of these improvements and county administrations could help, financially and by technical cooperation in building up local color in the fishing communities. The problem seems to be largely one of education and it should not be assumed that the people in these small coastal communities are necessarily desirous of becoming meccas for the tourist and vacationer. It should be brought out that no overnight change in their status is intended and that the communities can develop gradually the recreational activities suitable to their own means and liking. For this purpose, however, the citizens will have to learn to regard visitors as friendly guests and willing sources of additional income.

PUBLIC TERMINAL PROJECTS: The assumption is too often made that the provision of marine terminals is, per se, the magic key opening the gateway to an immediate expansion of water-borne commerce over inland waterways. True, they are a requisite to such traffic, but should be viewed as just another connecting link in the transportation chain; they assist and condition that commerce but do not create the commodities of which it is composed. If potential water-borne tonnages are not produced, or received, in the surrounding area the only contribution which port facilities can make is to encourage the growth of industry, or other freight producing activity in the vicinity, which may eventually use water transportation. It must be assumed that corporate management will, before expanding at new locations, evaluate carefully the relative advantages of various forms of transport. In other words, future savings to the shipper must be apparent in advance in order to bring about this secondary, or delayed effect of promoting regional expansion by a new port development.

It is probable that a majority of public terminals are not directly self-supporting. This does not necessarily mean they should not have been built, since the indirect communal benefits may be considerable. A public terminal which is successful by either standard is usually one that is designed to meet a special situation, or where private enterprise cannot supply the need profitably because of its inability to pass on a portion of the cost to indirect beneficiaries.

There are too many examples throughout the country of general cargo terminals constructed by public agencies which have proved unsuccessful and eventually converted to other - usually storage - purposes. We have seen that there are only marginal, if any, cost advantages over a truck haul in transporting packaged freight by water for distances of less than about 150 miles if pick-up and delivery

charges are included. The many factors which caused the early growth and subsequent near-disappearance of these mixed general cargo movements are sufficiently apparent to serve as warnings against precipitant attempts to reverse this trend, unless very special conditions are involved. Also, there are numerous instances at coastal ports where wharves, and perhaps some covered storage, are in place and available to the public for handling general cargo but with no advantage being taken of these facilities for such purpose.

In dealing with public or private terminals some distinction must be made between general cargo of mixed commodities as compared with packaged freight of a uniform nature. An example of the latter would be a movement based solely upon one, or at most two, products such as tobacco hogsheads, baled cotton, sacked grain or sugar, bagged fertilizer and cement, unfinished steel products and pipe, or other cargo units not susceptible of bulk handling. This distinction assumes importance to the extent that loading and unloading practices can approach the simplicity of those used for bulk cargo. If a terminal can attract sufficient tonnages of a single commodity, or in standard containers efficient handling equipment and methods can be often adopted which eliminate the excessive use of manual labor. The consequent reduction in turn-around time would be an inducement to barge line operators and shipper alike.

In order to canvass some aspects of a public terminal a hypothetical installation, incorporating several types of facilities has been set up and very approximate cost estimates prepared. An attempt was made to include various elements that would be in large measure, provided or operated by private enterprise, but located within the confines of a public owned or sponsored project. The land, necessary bulk-heading, access channels and roads, filled areas and graded hardstands, would be provided by an appropriate public agency (town, city, county, organized port district, with or without state participation). In addition a general cargo, or special commodity barge terminal, with suitable storage and transit sheds, could be incorporated if and when fairly definite commitments were obtained from both shippers and barge line operators as to their needs and use. Similarly a grain elevator, adapted to barge loading, might be publicly financed but privately operated by two or more grain dealers so as to insure a competitive market. Commodity Credit Corporation storage would be provided if suitable arrangements could be made with that agency.

Approach channel dredging would be conducted so as to obtain maximum filled areas for prospective industrial plants whose products, or raw materials might, in part, be adaptable to barge transportation. Suitable areas for, and advance commitments would be made with an oil company for a water terminal, with suitable truck and tankcar service connections. This petroleum-products facility could well be placed beyond the more expensive bulkheaded section of the water frontage.

Those locations which have the following qualifications should be given priority consideration for the above outlined industrial-terminal complex:

- a. Reasonably close (one mile or less) access to an existing primary highway and railroad, with no expensive construction involved in making the connection.
- b. Within a relatively short commuting distance of a sizable community or equivalent labor supply.
- c. On an existing improved and Federally maintained waterway having project depths of 12 feet. The cost of dredging an access channel and turning basin at the terminal may be a critical item unless Federal assistance can be secured.
- d. Favorable sub-surface conditions with good drainage, or low-lying inexpensive areas which can be capitalized upon as spoil areas from dredging operations to provide income-producing made-land.
- e. Sufficient adjoining undeveloped areas suitable for expansion of industrial facilities.

The schematic layout shown on Plate No. 9 represents only one of many possible arrangements and may be entirely unadaptable to a particular site. Prospective industrial clients may dictate, in large measure, the internal assignments of space. For instance a feed mill or soybean oil plant might necessitate a regrouping involving the grain elevator. Nor is it intended that the facilities shown represent all the possibilities for this type of terminal complex. It was felt that the prospects of adapting the McLean sea-land proposal to shallow-draft transportation, using barges or specially designed craft, instead of ocean-going vessels, have not been sufficiently explored to warrant their inclusion in the layout presented. However, such a development could occur in the future as a result of relatively small changes in the many factors bearing upon transportation economics. Nor was any attempt made to adopt the general cargo facilities to any particular type of commodity. For instance, a barge loading station for scrap iron and steel or perhaps pulpwood, would need special attention in view of the probable protracted collecting and loading time involved. More elaborate cargo handling equipment than that provided by a mobile crane could be justified under certain conditions. The railroad and highway service roads shown should be thoroughly analyzed for possible savings. A re-entrant angle in the bulkhead alignment might be necessitated by approach channel conditions with improved space utilization in the terminal area but at the expense of barge maneuverability.

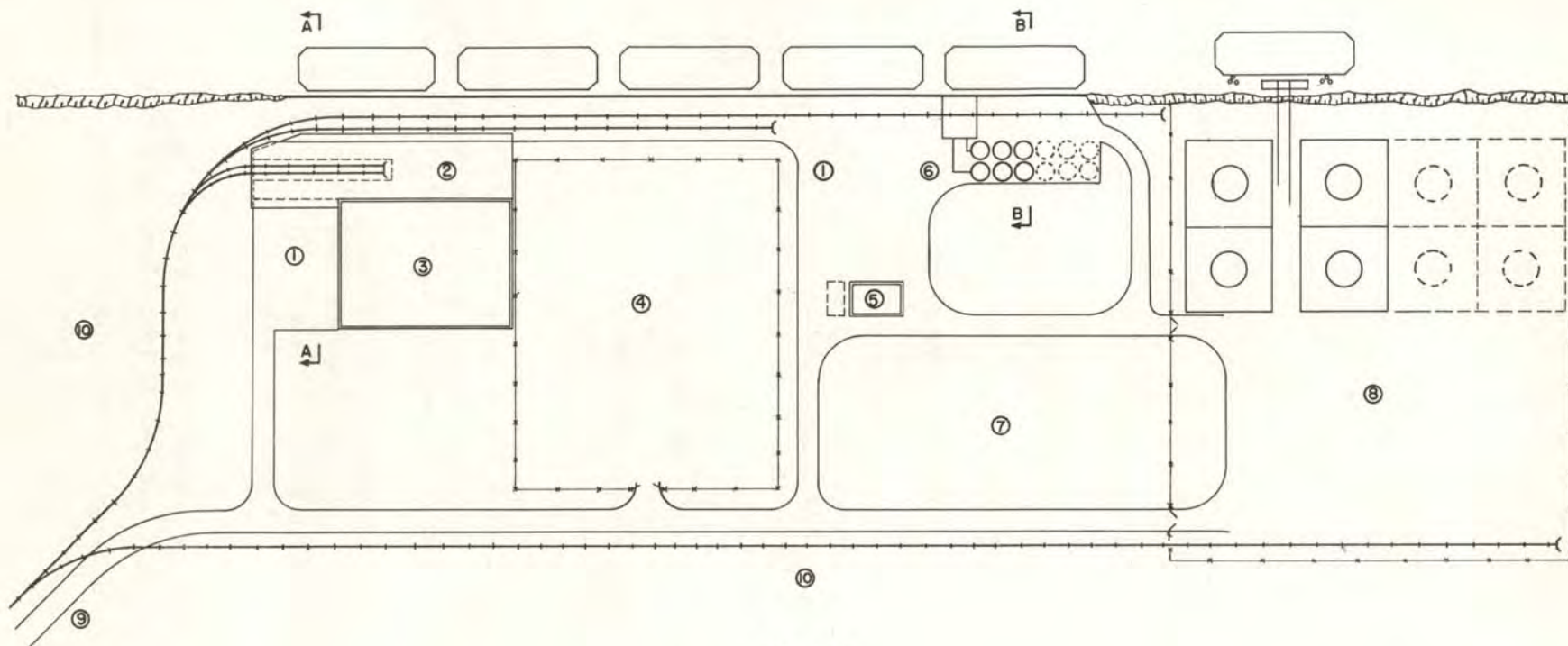
Obviously, the cost of such an installation will vary greatly with local conditions and the facilities provided. An approximate cost estimate was made for a first stage of construction, which would exclude any work on the oil facilities, the warehouse and the covered transit shed and associated tracks. Included in the cost were:

- a. Dredging of a turning basin 200 ft. wide by 1000 ft. long, and an access channel 100 ft. wide and 300 ft. long, both to a depth of 12 ft.
- b. A bulkhead 900 ft. in length, with timber fendering and mooring fixtures.

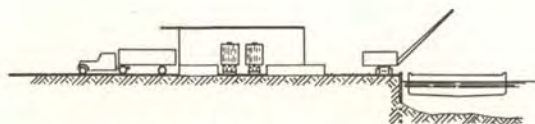
POSSIBLE LAYOUT FOR DEVELOPMENT OF SHALLOW-DRAFT TERMINAL

SCALE : 0 50 100 150 200

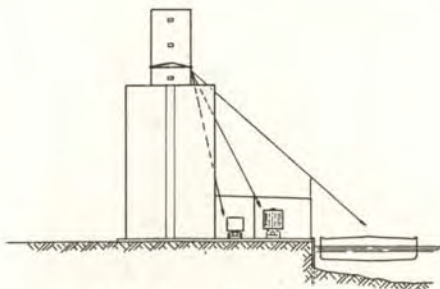
PLATE No. 9



PLAN



SECTION - AA



SECTION - BB

- ① TRUCK LOADING & PARKING AREA
- ② TRANSIT SHED - ROOF ONLY
- ③ WAREHOUSE
- ④ YARD AREA
- ⑤ WEIGHING STATION & PORT OFFICE
- ⑥ GRAIN ELEVATOR
- ⑦ PRODUCE MARKETING AREA
- ⑧ OIL DISTRIBUTION AREA
- ⑨ RAIL & HIGHWAY ACCESS
- ⑩ INDUSTRIAL AREA

- c. Two railroad tracks along the bulkhead, with a connecting spur of 1/2 mile to existing lines.
- d. A highway connection of the same length, and 5000 sq. yds. of paving in the terminal area.
- e. A grain elevator of 125,000 bushels capacity, concrete construction, with rail and truck unloading equipment and rail, truck and barge loading chutes.
- f. Grading and fencing for a yard area of 120,000 sq. ft.
- g. A ten-ton capacity crawler crane.
- h. A small office building with truck weighing scale.

The construction cost of such an installation, exclusive of land, would be in the order of \$950,000; a transit shed and warehouse of 54,000 sq. ft. combined floor area could be added for approximately \$300,000.

Based upon the above general observations and rough cost estimates it is apparent that many of the presently indefinite factors would have to be much more clearly resolved before even an approach could be attempted as to the economic feasibility of such a development. Further, assuming that deficits occurred in direct returns, how much of these could be written off or balanced against indirect communal benefits accruing from industrial expansion and enhanced property values? Perhaps the most important factor bearing upon the probable success of this type of venture concerns its location. Several possible sites have been considered and undoubtedly others are available. One in particular which meets generally the requirements set forth above is located across the Pamlico River from Washington, N. C. Although sub-surface conditions appear to be favorable, borings would be necessary as well as other field investigations. Of much more importance would be tonnage availability forecasts; studies as to industrial trends and potentialities; possible methods of financing and a degree of participation by private and public agencies; practicability of developing installations by stages and their relative priorities. These determinations are beyond the scope of this survey, in fact an adequate investigation for a single terminal would be a major engineering assignment.

Economic and engineering feasibility studies would have to be accompanied, or followed by tentative commitments from prospective commercial clients and users. Enabling legislation would have to be enacted by the State and subordinate political units, extending authority to charter and organize a suitable owning and operating public agency, such as a port district, empowered to issue revenue bonds, institute property condemnations, fix and assess terminal rates and rentals, plus such other perogatives as may be deemed necessary.

It would take some time to perform the above steps but this would not necessarily all be lost since several factors are working in favor of such a project in the interim. In the first place its basic supporting element, the tonnage potential of the entire area is gradually increasing. Again, there is at present little chance

of obtaining Federal assistance in providing an access channel or turning basin beyond the regularly authorized project limits. If and when international tensions ease, there might be a remote chance of obtaining this help, although it would be as an exception to generally applied policies of the Corps of Engineers.

Sound planning would be vitally important in any case. It is possible that only one or two of the facilities included in the present hypothetical study would prove feasible. Perhaps a grain elevator alone, partially supported by the inclusion of C.C.C. storage, plus the leasing to an oil company or an industrial plant of the reclaimed land, would prove to be the logical first step in the development. There is considerable evidence that certain sections of the Coastal Plain can support additional elevators. For instance Engelhard is an example of what can be done under adverse conditions and seriously restrictive (8 to 9 feet and sometimes less) channel depths. Grain from Engelhard must be barged all the way to Baltimore for export. When barge terminal facilities become available at Norfolk or, as discussed in Section IV, at either of North Carolina's deep-water ports, there will be an added incentive for inland waterway grain terminals. The development of suitable back-hauls for these out-bound grain movements would assist greatly in reducing unit water transportation costs. Present steps looking toward re-adjustment of certain freight rates to North Carolina ports might bring favorable results. In other words the picture is changing rapidly and in some respects for the better. Adequate planning must take proper cognizance of all these trends and their future implications.

The initial steps in this planning program could be undertaken without undue delay, and with only nominal expenditures. In view of the probable dispersion, local and state-wide, of possible future benefits, the costs of this investigational and planning phase might be apportioned on the basis of local and State participation. Perhaps an equitable arrangement would be that of matched funds. Certainly, local interests (city, county or a port district organized for the specific purpose) should contribute more than mere token amounts to this initial stage. It would lend to them an inspirational factor and a test of faith in their own project, while at the same time tend to discourage ill-advised ventures based on the hope that someone else would be "footing the bill" for a possible failure.

The employment by the State of one or more qualified specialists as needed, and their assignment to the study of each individual community's problem as the latter qualified for State assistance, might be a workable arrangement. Final designs and estimates would, of course, be well beyond the scope of these preliminary studies, the cost of which might vary from three or four thousand dollars, for the least elaborate installations, to several times that amount for an industrial-terminal complex as outlined above. These initial stage surveys should give at least as much emphasis to economic potentialities as they would devote to strictly engineering features and the estimated cost thereof. Retention by the State of the necessary specialists should tend to give the studies a broader and perhaps more realistic regional basis than would be the case if such were retained by individual communities. At the same time the latter would be protected from commitments supported largely by unwarranted enthusiasm.

XIII. RELATED PROBLEMS

Briefly discussed below are several subjects which have varying degrees of importance in the control and use of water in the Coastal Plain.

FLOOD CONTROL: The River and Harbor Act of 1927, Flood Control Act of 1936, and subsequent legislation have authorized investigation by the Corps of Engineers of the water resources of the country with respect to flood control, hydroelectric power, irrigation, water supply, and other purposes, in addition to navigation. Many projects have been recommended as a result, and Congress has authorized some of them for construction. Most of these projects are of the multiple-purpose type involving two or more of the above named elements.

The recently constructed John H. Kerr Reservoir, and the Philpott Dam, further upstream on the Roanoke River, have provisions for the storage of flood waters in addition to hydroelectric features. These two reservoirs are a part of a comprehensive plan for the development of the water resources of the Roanoke River, and its tributaries, which will eventually involve the construction of 11 dams. All but two of the dam sites are in Virginia and of these two one site (Roanoke Rapids) is being developed by private power interests and an application by the same company is pending for construction at the second location - near Gaston, N. C. Coordinated operation of this system of reservoirs will have very beneficial flood control effects throughout the lower reaches of this stream.

Although many river valleys in Eastern North Carolina have serious flood threats, with recurrent damages to crops, livestock and structures, it has been found difficult, or impossible, to justify economically the relatively large expenditures required in the provision of preventative measures. These may involve storage or detention reservoirs, channel realignments or cut-offs, levees or flood walls. The average annual value of the estimated flood damages which would be prevented must be, at least, equal to the annual carrying charges, including interest on the Federal investment, amortization, and maintenance costs. With the exception of reservoir projects local interests are usually required to furnish all necessary rights-of-way and assume responsibility for any future claims or damages which might result from the constructed works.

In order to obtain this favorable ratio between annual charges and benefits it is usually necessary for the protected areas to encompass urban or other districts having highly concentrated property values or where danger to human life is a factor. This situation is not found often, or to any pronounced degree, in the flood plains of the several streams in Eastern North Carolina which are subject to recurrent inundation.

In the comprehensive watershed surveys authorized by the 1927 River and Harbor Act (the so-called "308" studies) all the major streams and their tributaries in North Carolina were thoroughly investigated with a view to determining the feasibility of providing flood protection by any practical means, either alone or in combination with other purposes, such as hydroelectric developments. With the exception of a possible detention reservoir system on the Neuse River and

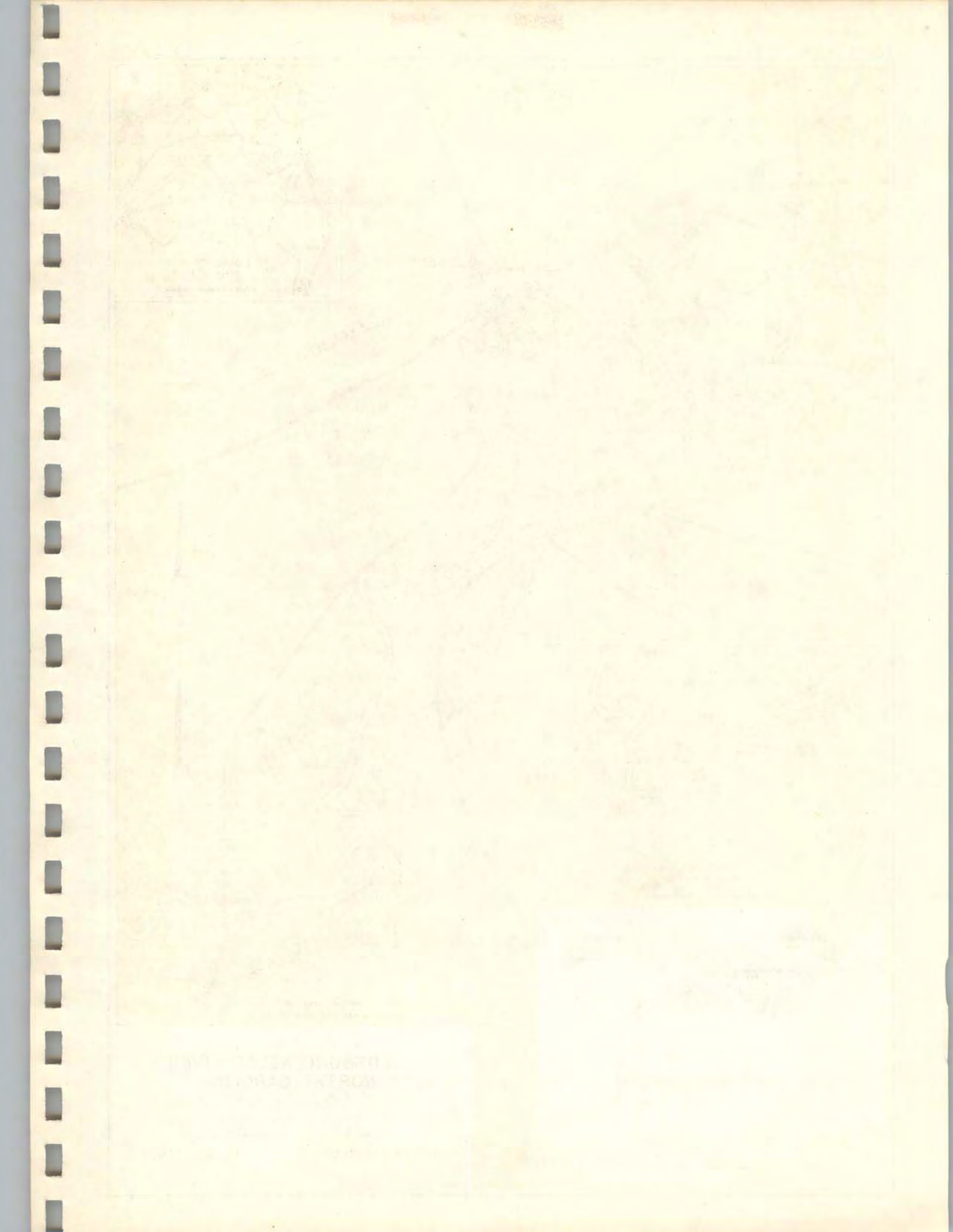
some isolated areas where minor protective works appeared to be practical, no flood control projects, with or without multiple-purpose facilities, could be found which approached economic justification. Of course, major changes with respect to increased property values which might be protected, have occurred since these studies were made in the early thirties. On the other hand construction costs have probably increased at an equal, or greater rate, and in view of the fact that some of the more promising solutions showed unfavorable ratios of charges to benefits by as much as five or more to one, it is more than doubtful that a restudy at this time would alter the previous findings in any material way.

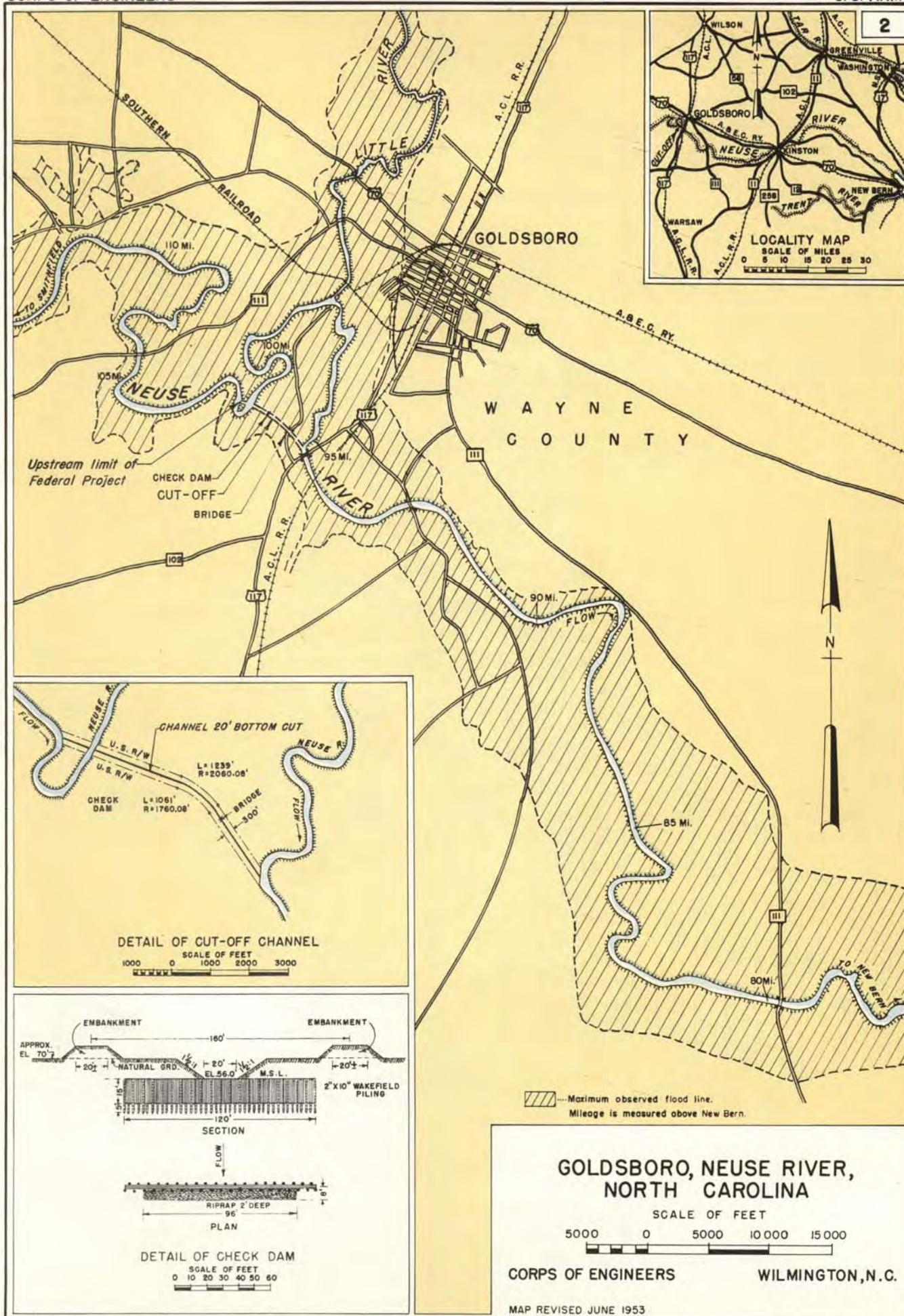
The "308" studies did conclude that future industrial expansion might bring about power demands sufficient to justify multiple-purpose developments on the upper Roanoke River which would include the provision of flood control storage at a number of likely reservoir sites. The present extensive construction programs on that stream, as noted above, resulted from subsequent studies and planning by both the Corps of Engineers and public service companies.

Work has been performed on a number of local flood control projects on streams within the Coastal Plain. These are listed and briefly outlined below. It will be noted that several of these did not receive formal authorization but were undertaken through the allotment of emergency repair (lock and dam) funds or under authority of Section 2 of the Flood Control Act of 1937, as amended, which permits allotment, not to exceed \$50,000, for any one stream, during a single year, for the removal of accumulated snags and other debris from, and clearing and straightening of channels in navigable streams and tributaries thereof, when such work is advisable in the interests of flood control.

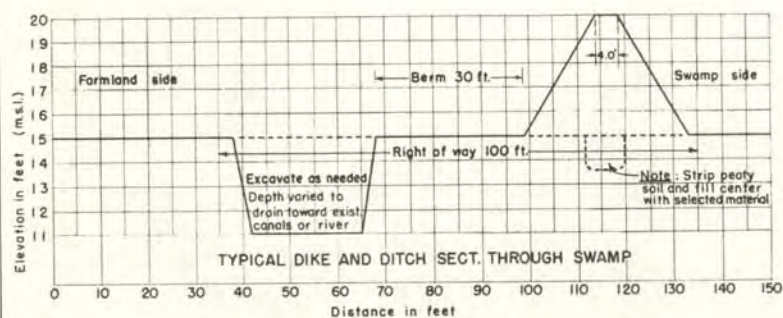
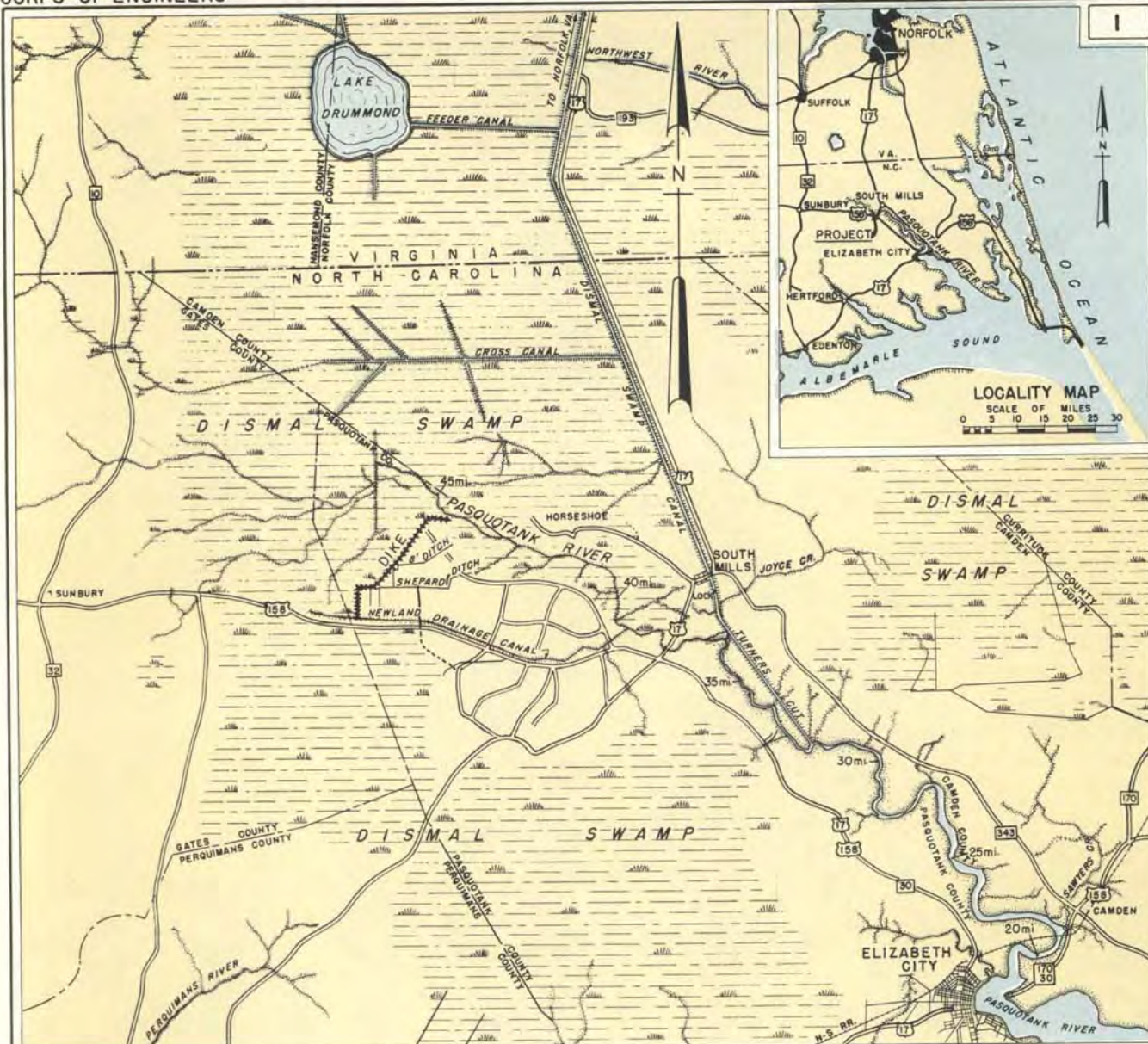
Pasquotank River:- (See Flood Control Project Map No. 1). This project provides for flood control by construction of a low dike and appurtenant outlet structures along the edge of the Dismal Swamp between Federal Highway 158, about 3.6 miles northeastward and eastward to within about 700 feet of Pasquotank River. The 1952 estimate of cost for the project is \$125,000. The average annual flood control benefits that the dike would provide are estimated at \$10,900. Protection against the highest flood of record would prevent damage from flooding and impaired drainage estimated at \$60,000. In addition to the evaluated benefits, substantial intangible benefits would accrue.

Goldsboro, Neuse River:- (See Flood Control Project Map No. 2). This project embraces that portion of Neuse River near Goldsboro, between points 94.8 and 102.5 miles above New Bern. The project provides for a cut-off channel about 6,400 feet long across two adjoining bends in Neuse River, shortening the channel by 7.7 miles; and a check dam across the bottom of the cut-off to force the low flow through the natural channel. The project was completed in May 1948 at a cost of about \$50,500 to the Federal Government and \$16,400 to local interests, including a bridge across the cut-off. Average annual flood benefits from the project are estimated at \$4,000. If a flood like that of September 1945, which has been equalled or exceeded on an average of once in 10 years, should occur, it is estimated that the cut-off would prevent flood damages of \$35,000. While the largest floods of record have occurred during the crop season and are relatively





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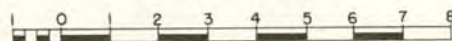


TYPICAL DIKE AND DITCH SECT. THROUGH SWAMP

TYPICAL DIKE SECTION

PASQUOTANK RIVER,
NORTH CAROLINA

SCALE OF MILES



CORPS OF ENGINEERS

WILMINGTON, N. C.

MAP REVISED JUNE 1953

frequent, none has occurred since the cut-off was completed. For that reason flood damages prevented have been small; they are estimated at \$2,500.

Snagging and clearing operations were performed on the following streams under the authority of the Flood Control Act of 1937.

Tar River:- This project provides for clearing and snagging the natural channel between Tarboro and Rocky Mount, a distance of about 40 miles. The work was completed in July 1938 at a Federal cost of about \$81,300. It is estimated that the improvement lowered flood stages of the 1940 flood, the greatest since the improvement was made, an average of 1-1/2 to 2 feet, and shortened the period of flooding, thus reducing flood damage about \$20,000. It is estimated that the project provided flood control benefits totaling about \$85,000 to June 30, 1952, an average annual benefit of about \$6,100.

Contentnea Creek:- Work was completed on this stream in 1942 at a cost of \$42,300 from regular funds and \$11,000 of Works Progress Administration funds.

Trent River:- During the fiscal year 1952, a Federal allotment of \$50,000 was received, plus \$15,000 contributed by local interests, for clearing and snagging Trent River between mile 38 and mile 75.5 above the mouth at New Bern. The project was completed in 1953 and will substantially lower flood stages and decrease the time of flooding above and along the improved reach, thereby providing flood control and improving drainage on about 5,000 acres of land.

New River:- During the fiscal year 1950, about 16.5 miles of New River were cleared and snagged for flood control, between miles 29.5 and 46.0, beginning about 10 miles above Jacksonville, at a cost of about \$33,900. The improvement substantially lowered flood stages and decreased the time of flooding, decreasing flood damage on about 1,000 acres of farm land and improving drainage on a much larger area.

Cape Fear River Dikes:- This work was done through an allotment from emergency repair funds. In May 1947, filling of the breaks caused by the September 1945 flood in about 5 miles of dike on the left bank of the Cape Fear River near Lock and Dam No. 1 was completed at a cost of \$36,500. These dikes were constructed by local interests about 1910; subsequent maintenance and general extension has been performed by the North Carolina State Highway and Public Works Commission.

The following preliminary examinations and surveys with respect to flood control have been assigned. Unless otherwise noted progress on these studies has been deferred due to lack of funds and their completion dates are indefinite. Some involve drainage as well as flood control problems.

Perquimans River:- An investigation of the feasibility of providing flood control and drainage improvements on the river.

Filberts Creek:- An investigation of local interests' desire for improvement of the stream in order to lower flood stages and improve drainage.

Pantego and Cucklers Creeks (Pungo River basin):- To determine advisability of providing flood control and major drainage for farm lands in the upper Pungo River basin by either enlarging existing trunk canals or excavating alternative intercepting canals.

Core Creek (Neuse River):- To investigate the advisability of flood control and drainage improvements in the Core Creek basin.

Neuse River between Smithfield and Wayne County line:- To determine the feasibility of flood-control improvements for farm lands along a 35-mile reach of Neuse River.

Neuse River and Tributaries:- An investigation to determine the feasibility of providing improvements to reduce floods, facilitate drainage, and permit higher utilization of land and water resources.

Northeast (Cape Fear) River:- An investigation of requests for improving drainage of lands along the river.

Cape Fear River:- To investigate the feasibility of improvements for flood control, drainage, and other purposes in the entire Cape Fear River basin. Preliminary examination report has been submitted recommending a survey; considerable field and office work has been completed, but completion of survey report has been deferred for lack of funds.

DRAINAGE: This problem has particular importance throughout the low-lying areas of the Coastal Plain. There are many tracts of fertile land with elevations down to actual sea level or even below. Some of these have been drained and brought into successful cultivation. Several extensive drainage projects, including one which will eventually involve some 40,000 acres in eastern Carteret County, have been started, or are in the planning stage.

The development around Mattamuskeet Lake, first started over 100 years ago, encompassed many thousands of acres. Elaborate drainage canals and large pumping plants were constructed and for a time the project, then under the New Holland Corporation, gave considerable promise of success. Following the completion of the Intracoastal Waterway in 1928, via the land cut between Alligator and Pungo Rivers, and bordering the drainage district on the north, troubles began to develop due to high salinity in the ground waters of the area, with concurrent destruction of crops. It was alleged that salt water intrusion from Pamlico Sound, by way of the Waterway and drainage canals, was responsible. In any case the Corporation failed and later interests obtained an authorization in 1948, for a review report by the Corps of Engineers, as to the Intracoastal Waterway allegations. Although the report did not find the Waterway entirely responsible it did recommend certain corrective works, including a pumping plant at Fairfield, to be provided at Federal expense. Funds in the amount of \$195,000 for fiscal year 1955 have been approved by Congress. In the meantime the U. S. Wildlife Service has taken over the lake and much of the marginal area as a waterfowl refuge.

A somewhat similar situation is claimed in an area north of Belhaven. In order to determine conditions, and find solutions, a preliminary examination by the Corps of Engineers has been authorized, as noted under the title of "Pantego and Cucklers Creeks," among the currently assigned flood control studies listed above. In addition, five of the other flood control surveys now under way involve drainage problems.

Although no reliable data are available, undoubtedly there are many thousands of acres in the coastal areas, now covered with mixed or scrub growth, which could be more profitably used for crops or pasture. Clearing and ditching these lands are expensive operations, particularly with older methods, using inadequate equipment. Heavy-duty ditching machinery of modern design represents a considerable capital investment, usually beyond the resources of the largest land owner, or even the small contract operator, specializing in this work. It is possible that an experimental unit might be purchased by the State or a subordinate political unit to demonstrate the feasibility and financial returns when used in custom or rental operations. Individual land owners would be charged rates which would meet operating costs. The objective of this program would be to improve drainage practices, show how unit costs can be reduced, and primarily to encourage private capital in similar ventures. In addition to two or more ditchers of different capacities, suitable auxiliary equipment, including trailers for easy mobility, should be provided. Such units might so reduce the present high cost of land drainage as to make practical the reclamation of many large tracts of presently unproductive land.

IRRIGATION: Many farmers are beginning to recognize the crop-insurance value and excellent returns which may accrue from supplementary irrigation. Perhaps the recent succession of years with below-normal rainfall has added impetus to this trend. The lack of rain during critical stages of the growing season can mean the difference between a bumper crop and a near total loss.

Not only are field, fruit and row crops materially increased but extensive application is being made, in other states, to pasture land with rather striking results, including higher protein production. With water when he wants it, the stockman can come closer to his goal of year-around pastures. Experiments in Florida show four times as much beef produced on an acre of irrigated pasture than on the same type of land without. Corn experiments in South Carolina showed irrigation increased yields by 49 bushels per acre. At a cost of \$17.15 for irrigation, a net return of \$69 was realized. Similarly with tobacco, yields were increased an average of 428 pounds per acre, at a cost of \$12.95 and a net return of \$278.54, or 21 times the cost of irrigation. Cotton yields went up 516 pounds per acre with net monetary returns 7 times greater than costs. In Virginia irrigation increased potato yields from 60 bags to 200-300 bags per acre.

With fair to excellent availability of surface flows in the Coastal Plain, together with an almost inexhaustible reserve of ground waters within easy pumping elevations, it would appear that a much more extended use of supplementary irrigation should, and undoubtedly will be put into effect in that region.

Cultivation of rice as practiced along the Lower Mississippi and in the Sacramento Valley of California might well be found applicable to some Coastal Plain areas. Although the latter were once important producers of rice, rising labor costs and antiquated hand methods have resulted in the abandonment of this once profitable crop. Most of these old low-lying fields have been allowed to revert to marsh growths. In other states this culture has been completely mechanized, from planting by airplane to combine-harvesting and contouring. Although rice normally has good salinity tolerance during part of its growing cycle, additional varieties are being developed with even better characteristics in this regard.

BEACH EROSION: Although by no means unique in this respect North Carolina's coastline is particularly susceptible to beach erosion and its attendant problems. Serious attacks have been, and are in progress, along several reaches where valuable beach properties are threatened, such as at Atlantic, Wrightsville and Carolina Beaches and in front of Fort Fisher below Wilmington.

A number of surveys and reports on these and other locations have been made over the past 25 years. One of the most recent of these was completed in 1947 by the Beach Erosion Board, a group composed of Corps of Engineer officers and civilian specialists, under the jurisdiction of the (then) War Department. The survey was made in cooperation with, and upon the formal application of the State of North Carolina (acting through the Department of Conservation and Development). It was authorized under the provisions of Section 2 of the River and Harbor Act of July 3, 1930, and before the enactment of subsequent (August 13, 1946) legislation which somewhat broadened the scope of these cooperative beach erosion programs, permitting Federal participation in the cost of protective structures where public interests are involved.

The report (published as House Document No. 763, 80th Congress, 2d Session) goes into considerable detail as to conditions along four critical sections of North Carolina's shoreline, comprising a total of about 50 miles of beaches. Since the survey was based upon the earlier authorization, in October 1946 it was agreed between representatives of the Board and the State of North Carolina that due to the fact the latter was unable to meet the requirements for a study of the more extended scope it waived any rights to Federal participation based upon the then nearly completed survey.

No estimates of costs or benefits were prepared; however, it was concluded that in addition to repairs and hydraulic fill at the existing groins on Wrightsville Beach, protective measures may be justified at Fort Macon and at the east end of Atlantic Beach. Some other conclusions reached are worthy of note, such as:

- a. The ocean shoreline of North Carolina is, in general, slowly retreating under the attack of winds, waves, and currents. It will continue to retreat in the future.
- b. Existing dunes afford valuable protection and should be preserved.
- c. Threatened structures can be protected by dunes, either constructed artificially or formed as a result of sand fences and planting. Low

portions of the barrier beach can be similarly protected except where the opening of new inlets is desired.

- d. Existing inlets will be unstable in the future as they have been in the past.
- e. Stabilization of these inlets cannot be effected at reasonable cost.
- f. New inlets will open, migrate and eventually close. The only measures considered to be practicable in effecting partial control of inlet changes comprise the construction of dunes to prevent breaching at low sections where new inlets are not desired, and dry excavation at low sections to facilitate breaching during storms where inlets are desired.

Much further study must be devoted to this problem in cooperation with the Beach Erosion Board and methods being tried elsewhere, with some success, should be thoroughly explored.

WATER POWER: There are few, if any, really good dam sites suitable for hydroelectric development in the Coastal Plain. In fact the latter is bounded on the west by the so-called Fall Line which is marked by a zone of relatively steep slopes where the Piedmont Plateau meets the lower areas to the east. Since good power sites are usually associated with river reaches of steeper gradients, such as, for instance Roanoke Rapids, few favorable dam sites, even of the low-head type, are found after the streams have dropped down from the higher country to the west.

Aside from the Roanoke River system of multiple-purpose reservoirs, mentioned under the Flood Control subsection above, and some fairly promising sites on the upper Cape Fear, (mostly without the limits of the Coastal Plain as adopted in this report) no really favorable locations for water power facilities which could compete successfully with steam generation, appear to be available east of the Fall Line.

WATER SUPPLY AND POLLUTION: In general, the water supply of North Carolina is adequate in quantity for the foreseeable future. The Water Resources Division of the Department of Conservation and Development has published a series of seven reports presenting hydrologic data on all the principal watersheds of the State. The purpose of these publications is to provide under one cover, to interested parties, useful hydrological information regarding each watershed.

Throughout the Mountain and the Piedmont Plateau regions, as well as the western part of the Coastal Plain, water is obtained primarily from the streams, wells being used only under special circumstances. On the other hand, in the Tidewater section fresh water for domestic and industrial uses is obtained from wells. The supply of ground water in the coastal area is estimated to be large enough to satisfy any foreseeable needs; nevertheless heavy concentrations of withdrawals will create the danger of salt water intrusion. The cities along the shores of the sounds are aware of this danger, and care is taken not to concentrate withdrawals.

Determination of the distance that underlying salt-water wedges may extend upstream into otherwise fresh-water courses is of considerable economic importance, especially with the increasing water demands of expanding industry in the area. In this connection the Raleigh office of the U. S. Geological Survey has recommended a program of reconnaissance surveys of the five watersheds in the Coastal Plain. It is estimated that these will cost in the order of \$3,000 for each watershed and will furnish sufficient data to properly respond to most of the present inquiries from industrial interests. They could be conducted by the U. S. Geological Survey in cooperation with the State. As industrial expansion accelerates it may become necessary to make more detailed surveys, incurring expenditures of about \$10,000 per watershed. Due to several factors, including the disrupting effect of these intruding salt-water wedges, lack of well defined control sections to which conventional methods of correlating stream discharges to gage readings are applicable, influence of wind tides which sometimes create reverse flows in the lower reaches of wide-mouthed rivers, it has proven impractical to establish satisfactory gaging stations in the lower sections of the larger streams. Consequently adequate run-off data are unavailable for the lower contributory drainage basins of the major rivers.

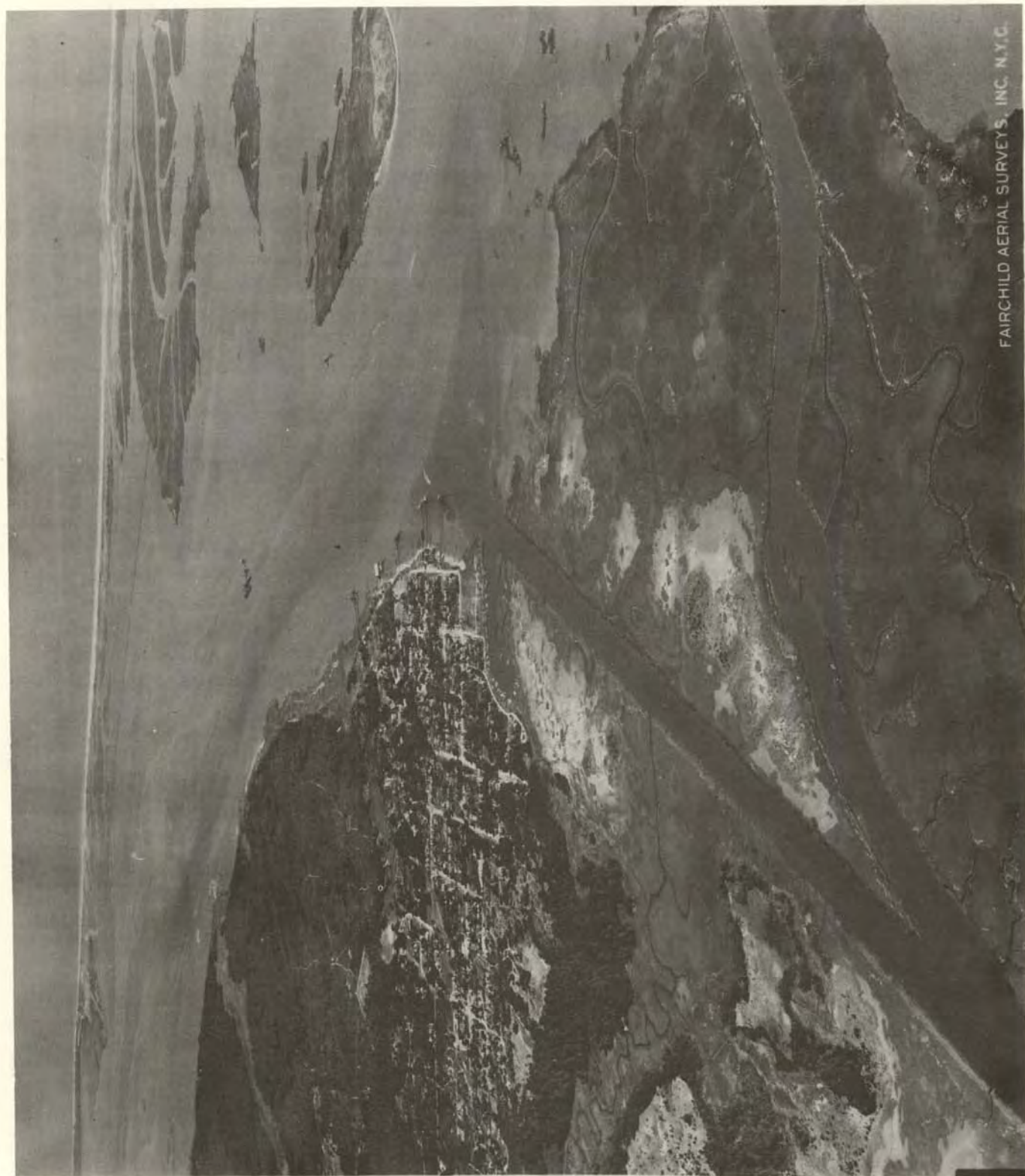
The discharge of insufficiently treated waste water into streams by cities and industries has brought about varying degrees of pollution in many parts of the country. This condition has been caused by lack of planning in the disposition of, and control over, the waste products of rapidly growing cities and industries. North Carolina has not been an exception to this trend, and as early as 1921 the State Board of Health took cognizance of the situation. It took such action as was then possible under its own authority with the cooperation of the Department of Conservation and Development and other interested groups, but not until 1945 was legislative support forthcoming. In that year the General Assembly passed an act creating the State Stream Sanitation and Conservation Committee for the purpose of investigating the stream pollution problem. No special funds were provided but with the help of the Department of Conservation and Development, the State Board of Health, and the State College Engineering Research Department, this Committee published a report in 1946 entitled, "North Carolina Stream Pollution Survey," which presented an analysis of the treatment of waste waters in all North Carolina watersheds. Its findings showed that the reduction of deleterious material by municipalities was 43 per cent, and that of industries only 16 per cent; it also recommended that more detailed studies be made of each of the watersheds. However, inadequate appropriations resulted in little further action until 1951, when the General Assembly passed a new law completely revising the original one, and covering all the waters of the State.

The present law created the State Stream Sanitation Committee, serving under the jurisdiction of the State Board of Health, and required it to conduct pollution surveys, establish classifications of water usage, and set standards of quality for various uses. In order to accomplish this, control over the quality of waste waters will be exercised by the Committee through the issuance of permits for any new waste discharge outlet, and of special orders to control existing outlets if their users have not voluntarily complied with the standards set by the Committee. The law is based upon the principle that compliance will be achieved through voluntary cooperation, and that controls will be applied only if necessary.

The new act brought with it renewed interest in the problem, and purposeful action is being taken. The first move by the Committee was to institute public hearings throughout the State in the matter of the classification of its waters and the setting of standards for such classifications. Hearings were held in July and August of 1953 and later various categories and standards were established officially.

Further action under this law has resulted in a survey of the Yadkin River basin and a report entitled "Pollution Survey Report No. 1, the Yadkin River Basin," has been published. It is the first comprehensive review of stream pollution in one of the State's watersheds and presents recommendations for classification of its waters. A total of 66 locations of significant pollution were found. It was also determined that the overall impurity reduction from domestic sewers and industrial outlets was only 21.6 per cent. The report concludes that more treatment than is presently given to waste waters must be provided, particularly by industrial plants. Public hearings on the survey having been concluded, it is expected that the Committee will formally establish the classifications of the basin's waters, and set the date on which control of the watershed will become effective. This will be the first watershed to come under the control of the Committee and the results obtained will furnish criteria for procedures in other watersheds.

Up to the present some voluntary action has been taken by municipalities and industries. With the completion of a survey of an entire watershed and the subsequent establishment of standards of classification of its waters, the provisions of the law will have been translated into practice. This will provide interested parties, municipalities and industries, a yardstick with which to measure the steps they may have to take to comply with the law and should speed up voluntary action, which up to the present has been slow.



FAIRCHILD AERIAL SURVEYS, INC. N.Y.C.

SOUTHPORT — *Intracoastal Waterway in foreground.*

XIV. FINDINGS AND CONCLUSIONS

A few of the more important facts and observations assembled or developed from this study are listed below:

Eastern North Carolina's mild weather, long growing season and well distributed rainfall is favorable to field and forest growths, stock raising and kindred pursuits. It provides pleasant living conditions for its people, an attraction to tourists and vacationers, and tends to lower the cost of industrial and home construction and their subsequent maintenance and operation.

The indented shoreline with its landlocked sounds, attenuated Outer Banks, offshore continental shelf and Gulf Stream, have had far-reaching effects upon the region's economic and social development. They have conditioned its means of livelihood, channeled its communications and lent character and self-reliance to its people. The instability of the openings through the outer barriers has proven a serious problem in the development of maritime activities. On the other hand, the relatively limited work required to provide navigable interconnections between the chain of sounds has made possible the Intracoastal Waterway which gives the Tidewater region protected access to Atlantic and Gulf Coast ports.

Various factors dating back to early Colonial and Civil War days have given an essentially agrarian character to the economy of Eastern North Carolina with only limited development of industrial enterprises. Until comparatively recent years very little of its agricultural production was processed within the area. Lack of modern grading and marketing practices imposed serious handicaps on its produce at outlets in neighboring states. Lack of storage facilities made carry-over impractical whereby advantages could be taken of fluctuating prices. One-crop practices brought on soil depletion and attendant evils.

Sociological progress has been threatened by the high prevalence of sharecropping and other undesirable forms of farm tenure. The advantages of diversification and crop rotation have been neglected or lost. The enhancement in value of farm produce through stock feeding has not been adequately exploited. Farm mechanization has been unduly retarded by the above and other factors. Only through assumption of responsibility by the State for county roads and, to a large measure, the educational system, have public services kept pace with needs. This has meant proportionately higher tax burdens on the more prosperous sections of the State.

The strictures upon economic opportunity have induced very serious emigration from these eastern areas to the extent that a number of counties have shown consistent population losses through the years. These losses have come preponderantly from the younger generation, leaving an unduly high percentage of very young and the very old. Means must be found whereby these inroads upon the State's most valuable resource, its young people, can be stopped, or preferably, the trend reversed.

Next to agricultural pursuits, those dependent upon forestry are the mainstay of the Coastal Plain economy. The seemingly inexhaustable timber reserves encouraged shortsighted practices predicated upon "mining" rather than harvesting these invaluable resources. Although State sponsored conservation programs have stemmed this wasteful, and even dangerous course, much yet remains to be done if her forests are to continue indefinitely as the base for many of the State's primary industries. A fuller development of manufacturing processes which are supported by forest products will bring greatly increased returns over those resulting from the export of these raw materials.

Educational and assistance programs for improved farm woodland management and income are underway and should be further expanded. Forest fire control measures are becoming increasingly more effective. The distribution of seedlings from State operated tree nurseries is showing excellent results, although there continues to be a slight net loss of pine regrowth as compared to increased percentages in the hardwood varieties. There appears to be highly promising potentialities in any steps which will more fully develop the utilization of wood wastes resulting from lumbering and milling operations as now practiced.

Commercial fisheries have a considerably more important influence upon the lives of a comparatively small group of coastal people than is indicated by the dollar value of its products. The non-edible menhaden catch enters into many processes using mass production methods at plants within the State which gives to it a leading role over all other types of fishery. The finfish catch depends largely upon local shippers for its market, with relatively little processing done locally. Shrimp and crab production appear to be on the increase, whereas the oyster take shows a persistent decline. Limitation as to the leasing of bed acreages and the discontinuance of private grants may be deterrents to large scale operations, including bed development by private interests, even though it has given an individualistic aspect to this pursuit. Pollution and salinity changes have sometimes caused localized declines and adverse conditions for both fin and shellfish. The industry will require assistance in the fields of research, more extensive local processing, modernized fishing techniques, better marketing practices, and improved waterways, if it is to assume what appears to be its rightful place in the economy of the maritime counties.

Industry is expanding at an impressive rate in this and other southern states. Although transfers of facilities from other sections of the country have contributed in some limited degree to this phenomenal growth, most of it has resulted from corporate expansion of local and "foreign" companies, based upon the need for additional plants and branches, plus the establishment of entirely new industries and businesses. These developments have been induced by definite and fundamental advantages inherent in the local scene. Some of the more important of these are:

- a. Weather factors favorable to many aspects of the local environment.
- b. Labor availability, productivity, and aptitude.

- c. Higher stability in its near 100-per cent native-born population, conducive to better employer-labor relations as compared to regions which are sensitive to advanced unionization.
- d. Plentiful and varied raw materials which can support a multitude of basic and secondary industries.
- e. Conservative governmental policies with stable and equitable tax structures at local and State levels, and low employment tax rates.
- f. Relative availability of nearby out-of-state markets and undeveloped potentialities of local outlets.

A review of these advantageous factors indicate that most, or all of them, have considerable promise of continuing indefinitely. Extending this analysis to the coastal areas shows that their applicability is at least equal to that in other sections of the State, and that some factors, such as labor availability due to further increased farm mechanization, have added effectiveness. Industrial diversification, together with imaginative enterprise, should bring about a general resurgence in the Coastal Plain's economy.

In and about the coastal waters of North Carolina, nature has provided unequaled opportunities for the sportsman, an inviting playground for the tourist, and pleasant surroundings for its working people or those who seek surcease and rest. Although much has been done to add to nature's contribution, some of the small ports and village waterfronts could be made much more attractive to the transient yachtsman. Municipal and private marinas, with more extensive facilities and services, are needed. Small harbors of refuge could be provided along exposed reaches of the inland waterways without excessive cost.

The Outer Banks present a wealth of recreational opportunities, from primitive seclusion to seashore resorts with summer cottages, inns and populous beaches. The 30,000-acre Cape Hatteras National Seashore Recreation Area, first of its kind, gives promise of becoming a major tourist objective. A toll road, now proposed, between Virginia Beach, Va., and Nags Head will open a 50-mile seacoast with many possibilities. A thousand miles and more of inland streams and protected waters present untold opportunities for development, while serving as a scenic backdrop to primitive areas.

Eastern North Carolina has, for the most part, good land transportation facilities, although a hundred years of effort has yet to provide a through east-west railroad under one system, and spanning the entire State. Responsibility for the secondary road system was assumed by the State in 1931 and during recent years emphasis was given to the county road program. These have been widely extended and their maintenance requires considerable outlay. Studies are currently in progress with regard to future highway programs.

The many sounds and wide river-mouth estuaries, with marginal swamplands, tend to increase the difficulties and cost of highway construction, particularly of north-south arteries. The instability of Outer Bank inlets will impose very serious obstacles to the substitution of bridge structures for present ferry service.

Both railroad and airline networks have predominately north-south orientations with lesser services to Ohio and Mississippi Valley points. The rapidly expanding use of private and company-owned planes for business and sales purposes necessitates more emphasis upon well planned municipal airports in many of the larger and medium sized communities. Lack of airport facilities is often the deciding factor in the choice of industrial sites and may eliminate consideration of towns before their citizens can correct the deficiency.

The natural and improved waterways of Eastern North Carolina represent in some respects transportation and other assets unmatched by any other state or, for that matter, any other country. These interconnected channels extend across the entire eastern front and penetrate a hundred miles or more into the interior. This vast network forms the half-way point and nucleus for the Intracoastal Waterway which provides a protected route from North Atlantic points to Gulf Coast ports and the Mississippi system.

Except for the deep-water gateways at the Cape Fear River mouth and Beaufort Inlet, access to the ocean is denied to all but shallow-draft vessels. The numerous openings through the coastal barriers not only tend to migrate and close abruptly during storms, but are subject to shoaling and restrictive depths for even smaller craft. Stabilization of these inlets, even with very expensive jetties, cannot be guaranteed and use of other than the self-contained type of hopper dredge is impractical in these exposed barrier openings. With the smallest available hopper dredge drawing about 9 feet light the opening and maintenance of inlet channels has presented some very difficult problems which, perhaps, only specialized equipment and methods may resolve.

The Federal Government has spent a total of over \$20,000,000 in the provision of some 1,100 miles of navigable channels within the State and equal amounts upon their subsequent maintenance. Over 50 projects and sub-projects have been authorized by Congress following favorable recommendations by the Corps of Engineers. Of these, only about half have been completed and a number of them have been deferred pending further investigations of the need for changing the authorized plan or because of impracticability. Funds in the amount of about \$12,000,000 will be needed to accomplish the already authorized works. In addition four more projects, with estimated total cost of about \$400,000, have been favorably acted upon during the current session of Congress. Some ten or more preliminary examinations and surveys of proposed improvements have been assigned to the U. S. District Office at Wilmington.

For the past several years of international tensions river and harbor appropriations have been severely curtailed. During the present (1954) fiscal year less than \$1,000,000 has been allotted in support of all such work in North Carolina and almost all of this was assigned to maintenance operations. Only \$1,500 of new funds for surveys was made available. There appears to be considerable likelihood that these strictures will continue for some years to come and that only those North Carolina projects with highest priorities and which show the most promising ratio of prospective benefits to carrying charges, will receive allocations from Federal sources.

If the above assumption is correct it will mean that any acceleration of waterway improvements must depend upon funds being made available from other sources, or that any proposed programs for the better utilization and development of the State's inland ports and waterways must be based upon existing channel conditions. Presumably any supplementary funds would have to be provided at the State level and source from present or newly improvised revenues, such as elimination of gasoline tax refund privileges for marine craft, increased fees against the latter or assessments on commercial fisheries and other maritime interests.

If such a State sponsored Waterway Development Fund is to be set up it should be used in support of those projects which result in benefits to widespread and varied interests. Every effort should be made to increase the probability of later reimbursement for State expenditures from subsequent Federal appropriations by compliance with existing enabling acts and other requirements. In so far as it is administratively possible actual construction work, programmed and supported by the State, should be done through the established facilities of the Corps of Engineers, with a view to reducing overhead by eliminating the need for State provided technical and administrative staffs.

Water-borne commerce of general cargo, particularly of mixed commodities, by common carriers to and from North Carolina's inland ports has all but disappeared and have greatly declined on other waterways throughout the country. However, the movement of bulk cargos, such as petroleum products, pulpwood, grains, sand and gravel and some special classes of packaged freight, is increasing. Most of these latter shipments depend upon contract and company-owned or operated barge lines not subject to Interstate Commerce Commission regulation.

High terminal costs, particularly applicable to general cargo, have increased the overall cost of this type of movement to the extent that, except for the longer hauls of 400 miles or more, they cannot compete with rail and truck common carrier service. High terminal handling costs, plus the flexibility and speed of truck transportation has increased the probabilities for success of a proposed sea-land combined operation, whereby loaded trailers are picked up at various Atlantic ports and transported aboard specially designed ocean-going vessels to terminals needing only limited discharging facilities. The possibility of adapting this idea to a barge-truck carrier combination is being studied by various interests, either as a through service or as feeder lines to the deep-draft movements.

Practically all marine terminals now operating in the Coastal Plain, except the deep-water State Ports Authority installations at Wilmington and Morehead City, are privately owned and operated. A few small docks give wharfage privileges to all craft, if facilities are not otherwise in use. A number of municipal terminals have been constructed in the past but none have been sufficiently successful to warrant continued operations and at present are leased or have been sold to private concerns for storage and other purposes. Oil terminals, pulpwood loading installations, and other facilities handling a single commodity have been, and will continue to be, designed and operated to meet the specific requirements of a particular industry.

Most of the marinas serving pleasure craft are also privately operated. There appears to be need for more such facilities and better services if transient boats are to be attracted and induced to make longer than short stops for supplies and fuel.

Increased water-borne commerce will not necessarily follow the provision of added terminal facilities, either by public agencies or private interests. Municipal terminals are frequently operated at a loss but may be considered justified from the viewpoint of indirect community benefits. It is not believed that these latter would be of sufficient extent to warrant the construction of a general cargo terminal by a city or local port district. However, there may be some promise in the provision of a port development which would combine several facilities in addition to a general cargo or special commodity terminal. Bulkheading would be needed and spoil from necessary approach-channel dredging could be used as fill for industrial sites, grain elevator, oil terminal and other purposes, the made-land and adjacent areas being leased to private concerns, thus providing one source of revenue.

There are a number of suitable sites at or near some of the larger Coastal Plain communities, one such being across the Pamlico River from Washington. Approximate cost estimates have been prepared for a first stage development, including dredging access channel and turning basin, bulkheading, service and connecting railroads and highways, 125,000-bushel grain elevator, grading and fencing, small office and truck scales, and a ten-ton crawler crane. The estimates do not include the oil facilities or the marine terminal warehouse and transit shed. These could be constructed as a second stage development if and when advance commitments are made with shippers and/or carriers for their use. Commodity Credit Corporation grain storage would be made available in the elevator as an additional revenue source, provided rental guarantees are made with that agency.

The estimated cost of the first stage is \$950,000 but might vary considerably from this amount depending upon local conditions as to required length of access channel, highway and railroad connections and sub-surface conditions. Comprehensive planning, with detailed analyses of both construction costs and potential revenues, must be made before embarking upon a venture of this nature.

Investigations should be completed, without delay as to the feasibility of providing a grain terminal, with or without Commodity Credit Corporation storage provisions, at either of the State Ports Authority installations in Wilmington or Morehead City, in competition with the present export outlet through Baltimore. Due consideration should be given to the development of a suitable back-haul, such as fertilizer, on out-bound barge movements of grain to the State's deep-water terminals.

Although serious flooding often occurs along several Coastal Plain streams, most of the damages are to crops and do not critically involve concentrated property values in the larger towns. It has therefore been difficult to find flood control projects which will show favorable ratios of costs to probable benefits, as represented by the damages which would be prevented. The comprehensive upper

Roanoke River developments, including the multiple-purpose John H. Kerr and Philpott reservoirs, will give a high degree of flood protection to lower reaches of this river when all units are completed. A number of small flood control projects involving levees, cut-offs and snagging have been completed or authorized by the Federal Government. The relatively flat stream gradients below the Fall Line provide few, if any, practical dam and reservoir sites where power can be economically developed, either alone or in combination with flood control storage.

There are thousands of acres of low-lying fertile land in the Tidewater area which could be converted to crops or pasture if properly drained. Extensive drainage projects have been undertaken in the past and others are in progress or planned. Possibilities exist for a State or county sponsored demonstration unit, employing suitable heavy ditching equipment, with a view to encouraging the use of similar mobile units by private enterprise. A number of proposed drainage projects are now assigned to the Corps of Engineers for study and report, with a view to possible Federal participation.

There are excellent opportunities for more extensive use of supplementary irrigation, using surface flows or ground water sources. Net returns of increased crop values as compared to the cost of irrigation facilities have been ten or more to one in neighboring states. Profitable rice culture might be restored in Eastern North Carolina if 100-per cent mechanization is applied as in other regions, and varieties having higher salinity tolerances are developed.

Beach erosion constitutes a serious threat at a number of coastal points. Co-operative studies, using the technical services of the Federally constituted Beach Erosion Board, should be continued and expanded. Corrective measures using groins at Wrightsville and Kure Beaches appear to be effective and not excessively expensive.

Water supply is of increasing importance as industrial and municipal demands are accelerated. Ground water sources appear to be generally adequate to meet foreseeable needs; however, surface flow deficiencies are already being encountered at some locations and others are impending. Many streams have been polluted by excessive dumping of industrial wastes and untreated sewage. The State has recently initiated corrective action. The collection and dissemination of stream flow data, in cooperation with the U.S. Geological Survey, should be continued and expanded to include a survey of intrusive salt-water wedges in otherwise fresh water streams.

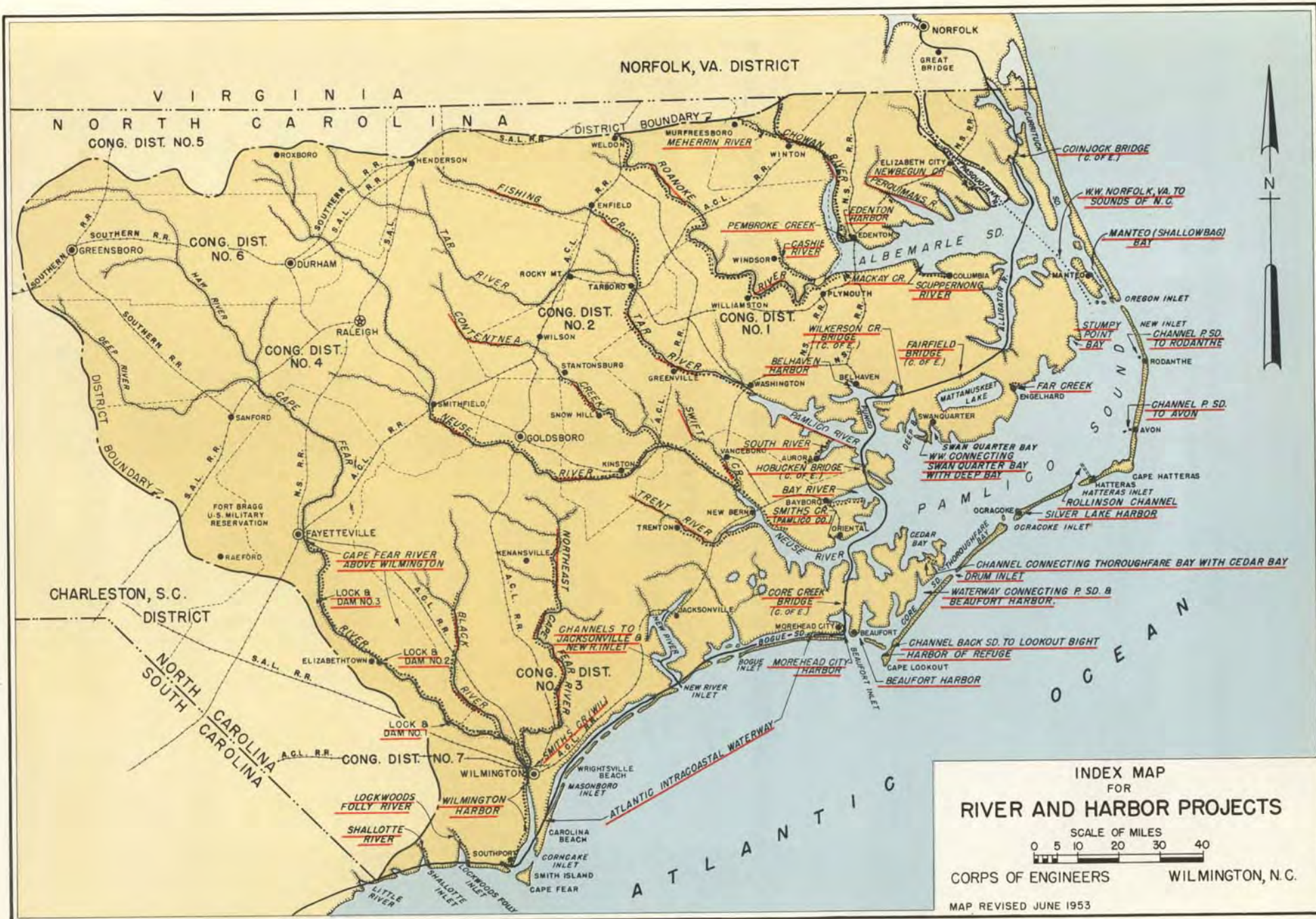
The above represent a few fields in which progressive and beneficial developments may accrue from North Carolina's impressive advantages and her great natural and human resources. Many other opportunities undoubtedly exist or may arise from the programs suggested.



APPENDIX A

AUTHORIZED FEDERAL RIVER AND HARBOR PROJECTS

IN NORTH CAROLINA



INDEX OF AUTHORIZED FEDERAL RIVER AND HARBOR PROJECTS

<u>NO.</u>	<u>TITLE</u>
1	ATLANTIC INTRACOASTAL WATERWAY BETWEEN NORFOLK, VA. and the ST. JOHNS RIVER, FLA. (Wilmington District Section)
1c	CHANNELS TO JACKSONVILLE, N. C. and NEW RIVER INLET
2	MEHERRIN RIVER
3	NEWBEGUN CREEK
4	PERQUIMANS RIVER
5	CHOWAN RIVER
6	WATERWAY - NORFOLK, VA. , TO SOUNDS OF N. C.
7	EDENTON HARBOR
8	PEMBROKE CREEK (Edenton Harbor)
9	CASHIE RIVER
10	ROANOKE RIVER
11	FISHING CREEK
12	MACKAY CREEK
13	SCUPPERNONG RIVER
14	MANTEO (SHALLOW BAG) BAY
15	STUMPY POINT BAY
16	CHANNEL FROM PAMLICO SOUND TO RODANTHE
17	BELHAVEN HARBOR
18	FAR CREEK
19	WATERWAY CONNECTING SWAN QUARTER WITH DEEP BAY
20	CHANNEL FROM PAMLICO SOUND TO AVON
21	PAMLICO & TAR RIVERS
22	SOUTH RIVER
23	ROLLINSON CHANNEL
24	BAY RIVER
25	SILVER LAKE HARBOR (Ocracoke)
26	NEUSE RIVER
27	CONTENTNEA CREEK
28	SWIFT CREEK
29	TRENT RIVER
30	SMITHS CREEK (Pamlico County - Oriental)
31	CHANNEL CONNECTING THOROUGHFARE BAY WITH CEDAR BAY
32	DRUM INLET
33	WATERWAY CONNECTING PAMLICO SD. & BEAUFORT HARBOR
34	MOREHEAD CITY HARBOR
35	BEAUFORT HARBOR
36	CHANNEL FROM BACK SOUND TO LOOKOUT BIGHT
37	HARBOR OF REFUGE, CAPE LOOKOUT
38	CAPE FEAR RIVER ABOVE WILMINGTON
39	NORTHEAST (CAPE FEAR) RIVER
40	BLACK RIVER
41	SMITHS CREEK (Wilmington)
42	WILMINGTON HARBOR
42a	TURNING BASIN AND APPROACHES (Wilmington Harbor)
42b	25 FOOT CHANNEL & TURNING BASIN (Wilmington Harbor)
43	LOCKWOODS FOLLY RIVER
44	SHALLOTTE RIVER

THE ATLANTIC INTRACOASTAL WATERWAY

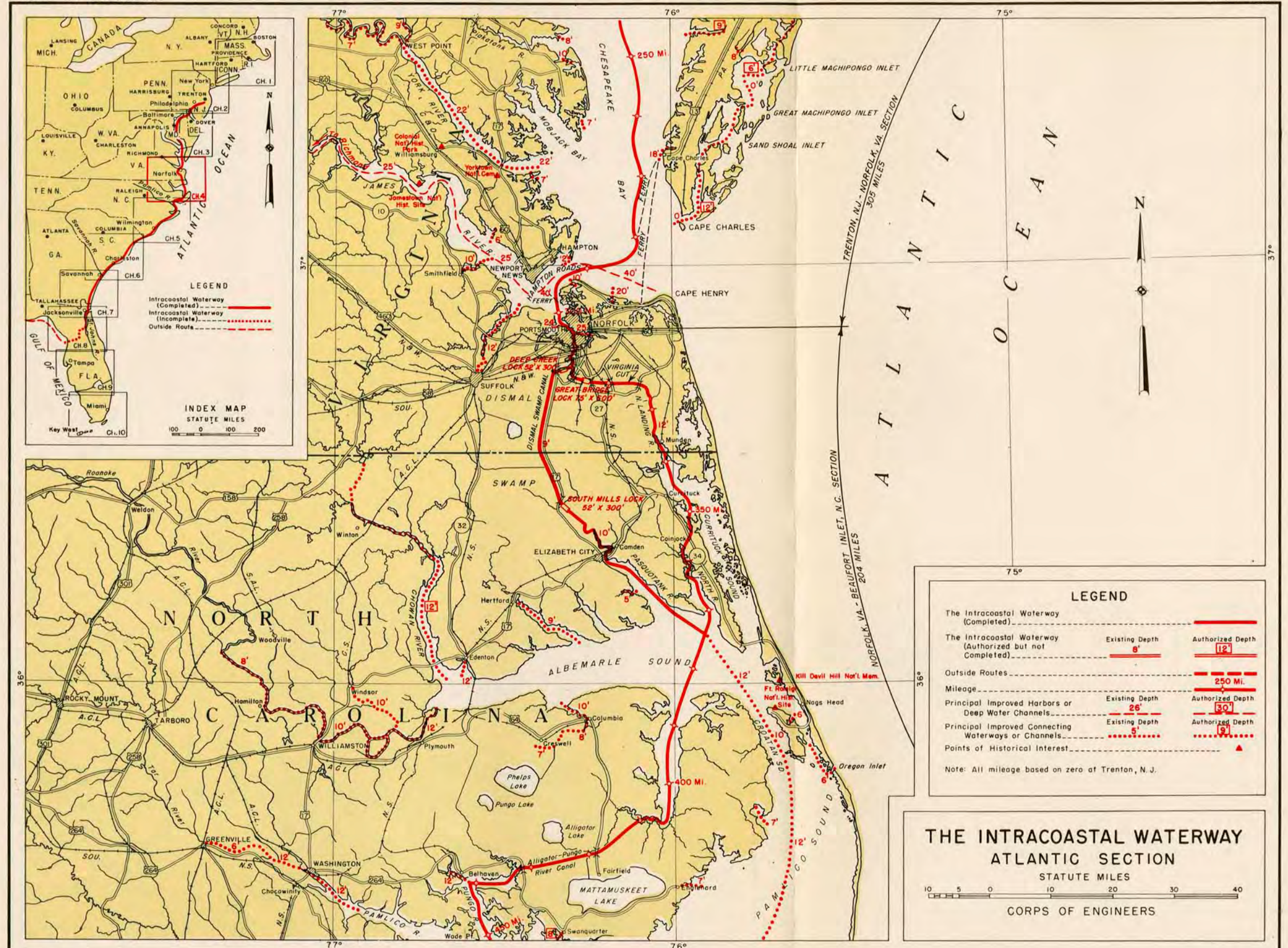
The above designation applies to the Atlantic section of a system of more or less connected waterways extending, except for a few gaps, from Boston, Mass., to Florida and along the Gulf coast to Brownsville, Texas. The authorized Cross-Florida Barge Canal will be, when completed, one of the two last major links (the other break is west of Mobile) in a through, protected waterway from Trenton, N. J., to the Rio Grande. There are open-ocean reaches between Boston and the mouth of the Delaware River. Until it was closed to traffic in recent years, the privately constructed (1831-1834) Delaware and Raritan Canal provided a water link between New York and Philadelphia. South of Norfolk this sea level route follows generally through the coastal sounds and marine marshes, with comparatively few heavy land cuts. It forms a vast system which, with its interconnections with many other improved waterways, such as the Hudson River and Erie Barge Canal, the numerous improved rivers flowing to the Atlantic, the Key West extension, and the Mississippi-Missouri-Ohio system, gives shallow-draft access to a major portion of the Eastern United States.

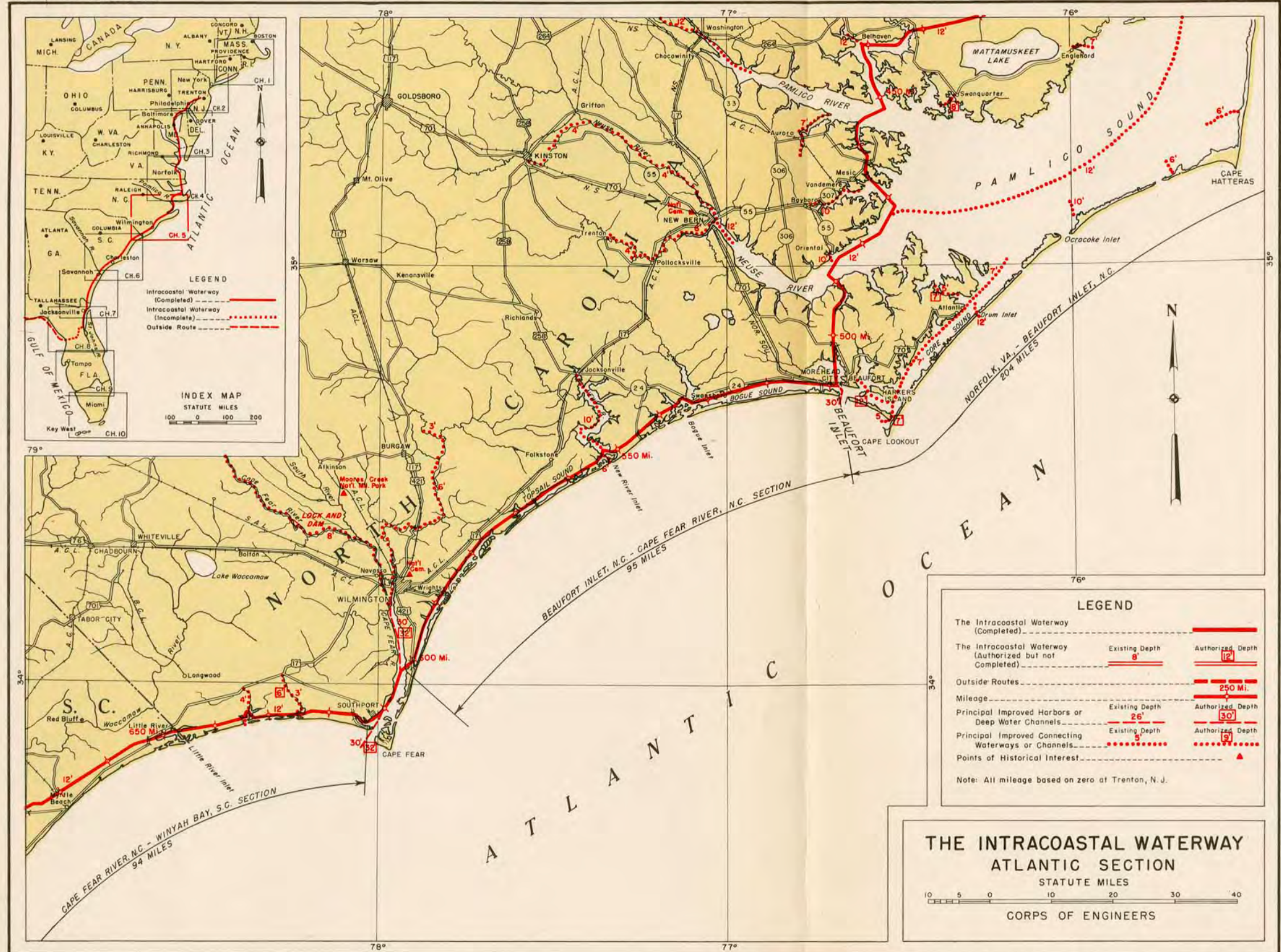
The extensive system now known as the Intracoastal Waterway had its beginnings in many small and unrelated improvements - George Washington made the surveys for the Dismal Swamp Canal in 1755, although it was not completed until 1820. The first Federal work was undertaken in 1828 (between the St. Johns River, Florida, and Cumberland Sound, Ga.). In 1837 a survey was authorized between the southern end of the Dismal Swamp Canal, in North Carolina, and Winyah Bay, S. C. Consistent improvement toward a comprehensive plan began in 1873, when a project was adopted providing for a channel 7 feet deep and 60 feet wide in the Southern Branch of Elizabeth River at Norfolk, Va., from Deep Creek to the northern entrance to the Albemarle and Chesapeake Canal, the latter having been started in 1856 by private enterprise.

Since then over 115 separate projects involving improvements of the Intracoastal Waterway have been adopted in addition to surveys and reports probably in excess of that number. Also numerous connecting channels and other adjuncts only indirectly related to this waterway have been authorized based upon so-called "Review" reports of previous studies directly concerned with the main system, for example Masonboro Inlet, the Fairfield pumping plant and the side channel to Jacksonville, N. C. This practice, requiring only a committee resolution, is a Congressional legislative procedure sometimes followed to expedite the study of a proposed project.

The numerous acts of authorization, frequent changes in official project designations and physical limits, plus the fact that even within the State of North Carolina, jurisdiction over this waterway is divided between two U. S. Engineer Districts (Norfolk, Va., and Wilmington, N. C.) makes it difficult to present a clear picture of its features and other pertinent data. For these reasons the following explanatory remarks may be in order.

PROJECT AND SUB-PROJECT DESIGNATIONS: Ignoring for the moment the various official designations that have been, and are currently applied to the several sections of this waterway, there are two alternate routes available south of Norfolk: one is by way of the Dismal Swamp Canal (including Deep Creek and Turners Cut) and the Pasquotank River to Albemarle Sound; the second follows the route of the old Albemarle and Chesapeake Canal (including Great Bridge - by which name it is sometimes designated - and the Virginia Cut) through the North Landing River, Currituck Sound and the North





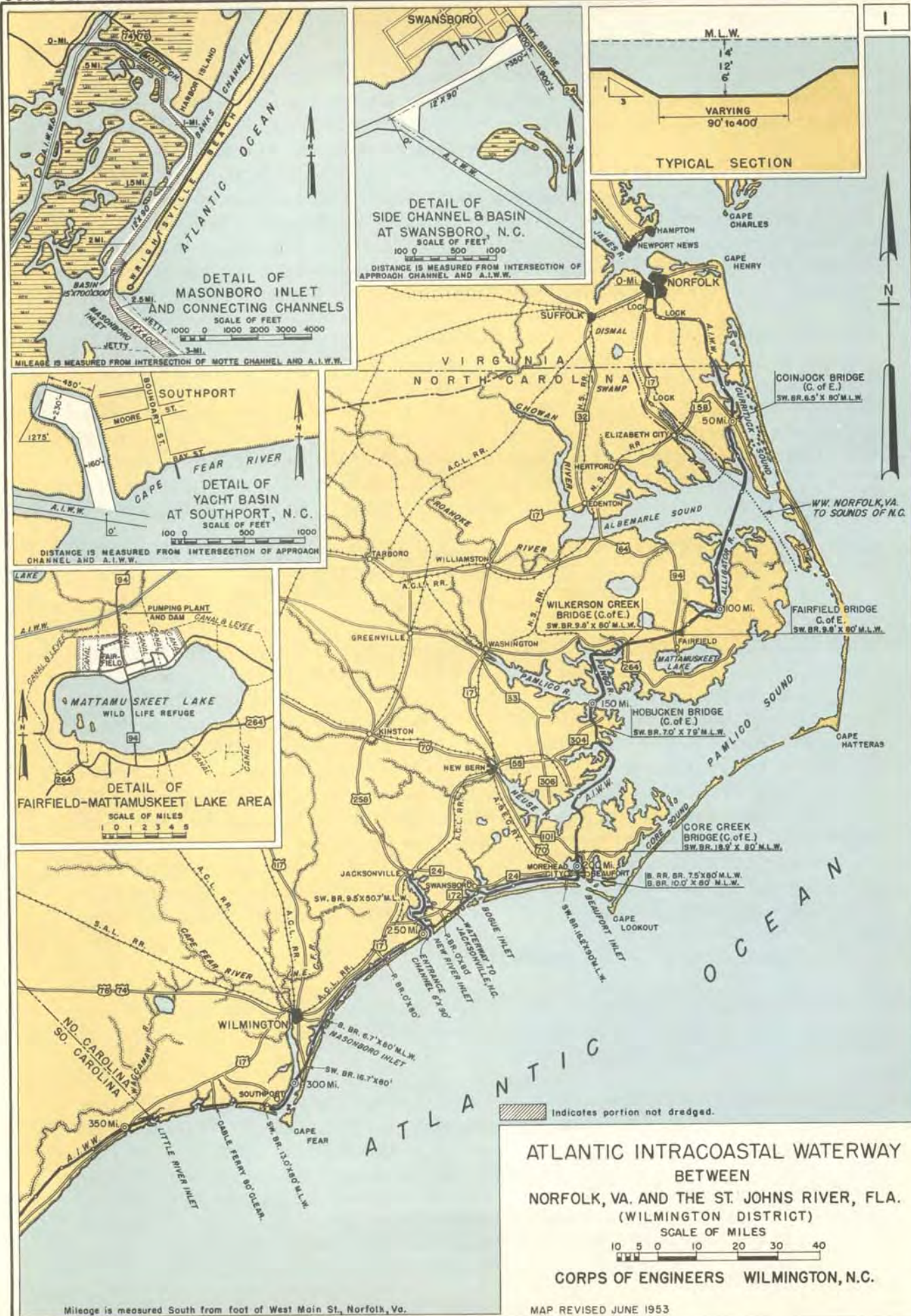
River to its junction with the Dismal Swamp Route in Albemarle Sound. Until 1946 the Dismal Swamp Route and its extension from the mouth of the Pasquotank through Albemarle and Croatan to Pamlico Sound was officially designated and reported upon as a separate project by the U. S. District Engineer at Norfolk, as the "Waterway - Norfolk, Va., to Sounds of North Carolina." In 1946 the completed and inactive extension, south of the mouth of the Pasquotank, was transferred to the jurisdiction of the Wilmington Engineer District and the above designation retained. Project Map No. 6 pertains to the entire Dismal Swamp Route. The Norfolk District jurisdiction over the Albemarle and Chesapeake route extends only to the Virginia - North Carolina boundary and since 1947 this northern section has been combined with the Dismal Swamp Route to the mouth of the Pasquotank. Prior to 1947 the northern section of the Intracoastal Waterway, via way of the Albemarle - Chesapeake route, was officially designated "Inland Waterway from Norfolk, Va., to Beaufort Inlet, N. C." In view of the above, care must be exercised in segregating and interpreting the project reports pertaining to costs, maintenance and commerce carried by the various segments of the Intracoastal Waterway. Plate Nos. 6 and 7, which have been reproduced by permission of the Army, show a portion of the Intracoastal Waterway, from Norfolk to South Carolina.

ATLANTIC INTRACOASTAL WATERWAY BETWEEN
NORFOLK, VA., AND THE ST. JOHNS RIVER, FLA.
(Wilmington District)

LIMITS AND SUB-PROJECTS: The section treated below begins at the Virginia-North Carolina State line (from where it connects with Norfolk via the Albemarle and Chesapeake Canal or Great Bridge route) and extends through Beaufort and the lower 10 mile reach of the Cape Fear River to the South Carolina boundary at Little River Inlet, a total distance of 308 miles. Although not integral parts of the waterway the following sub-projects have received Congressional authorization on the basis of being modifications of the overall Intracoastal Waterway system: channels to Jacksonville and New River Inlet, N. C., (see Project Map No. 1c); side channel and basin at Swansboro; Masonboro Inlet, including connecting channels and jetties; yacht basin and channels at Southport; salt water intrusion preventive measures near Fairfield - Mattamuskeet Lake; six mooring basins at various locations along the waterway; and a tidal lock in the land cut near the Cape Fear River (see small scale inserts on Project Map No. 1).

PREVIOUS PROJECTS: Numerous R & H Acts dating from 1836 to 1917 modified the former scope of improvements. About \$200,000 was expended prior to the adoption of the existing project.

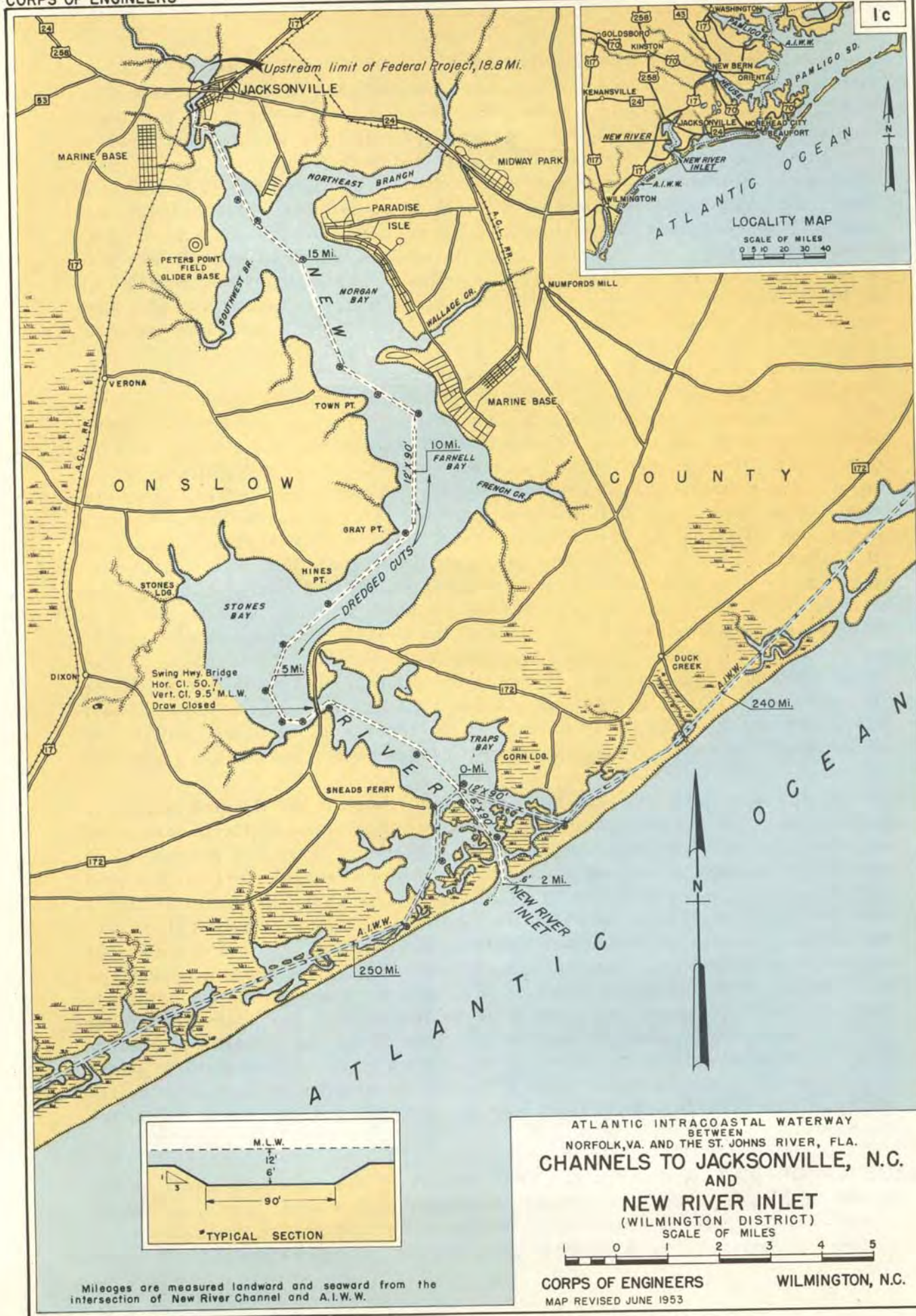
EXISTING PROJECT: Authorized by the R & H Acts of July 25, 1912; Aug. 8, 1917; July 18, 1918; Jan. 21, 1927; July 3, 1930; Mar. 4, 1933; June 26, 1934; Aug. 30, 1935; Aug. 26, 1937; June 20, 1938; Mar. 2, 1945; June 30, 1948; May 17, 1950 and provides for a waterway 12 feet deep at mean low water, with bottom widths varying from 90 feet in land cuts to 300 feet in open waters; for the construction, operation, and maintenance of suitable bridges; for a tidal lock in the land cut near the Cape Fear River; for a channel 12 feet deep at mean



low water and 90 feet wide on the bottom in New River between the Intracoastal Waterway and the Atlantic Coast Line Railroad bridge at Jacksonville, N. C., 21 miles, and a basin at Jacksonville of the same depth and varying in width; for a side channel 12 feet deep and 90 feet wide to a turning basin of the same depth, 200 feet wide and 350 feet long, opposite the principal wharves at Swansboro; for an entrance channel 6 feet deep and 90 feet wide at New River Inlet, with connecting channel of same dimensions to the Intracoastal Waterway near the mouth of New River; for 6 mooring basins at various locations along the waterway; for a channel 14 feet deep and 400 feet wide across the ocean bar at Masonboro Inlet, thence 12 feet deep and 90 feet wide to the channel of the Intracoastal Waterway at Wrightsville by way of Banks and Motte Channels; a turning basin 15 feet deep having a maximum width of 300 feet and length of 700 feet on the east side of Banks Channel near Masonboro Inlet, with three 15-pile dolphins therein; for a jetty on each side of Masonboro Inlet extending to the 14-foot depth in the ocean; for a yacht basin 230 feet wide, 450 feet long, and 12 feet deep near the town of Southport, connected with the waterway by a suitable channel of the same depth; and for salt water intrusion preventive measures in the vicinity of Fairfield, N. C., as follows: construction of a pumping plant and dam, with control gates and appurtenant works on Fairfield Canal near the Intracoastal Waterway; restoration and enlargement where necessary of Boundary Canal from the vicinity of Swindell Canal to the vicinity of Baum Canal, together with appurtenant works necessary to cut off inflow from other areas; and construction of dams with 30 inch automatic floodgates across Swindell, Florida, Burris and Baum Canals near Mattamuskeet Lake. (In 1949 the Chief of Engineers recommended that the project be modified to provide for a channel 12 feet deep, 90 feet wide, and about 1850 feet long extending from the 12-foot depth contour in the Intracoastal Waterway in Bogue Sound into Peltier Creek, with a basin 12 feet deep, 200 feet wide, and 600 feet long at the inner end, at an estimated cost of \$32,000. As yet no Congressional action has been taken on this proposal).

PROGRESS: The existing project is 69 per cent complete if all work presently authorized is completed - some items such as the jetties at Masonboro Inlet and the tidal lock in Snow Cut may be abandoned. If so the percentage of completion is about 81. That portion of the project between Norfolk, Va. and Beaufort, N. C. was completed in 1930; the 12-foot channel between Beaufort and the Cape Fear River, in 1932; the 12-foot side channel to Swansboro and the 10-foot channel in New River to Jacksonville, N. C., in 1939; the 6-foot channel from New River Inlet to the waterway, the 12-foot channel from Cape Fear River, N. C. to Little River, S. C., and the yacht basin at Southport, N. C. in 1940. No work has been done on that part of the project providing for: six mooring basins at various locations along the waterway; 12-foot depth in New River; 14-foot depth in Masonboro Inlet; 12-foot depth in Motte and Banks channels; and salt water intrusion preventive measures in the vicinity of Fairfield, N. C.; the tidal lock in Snow Cut; and the jetties at Masonboro Inlet.

VARIATION OF WATER SURFACE: That portion of the waterway north of the mouth of Neuse River is non-tidal; variation in the water surface, due to winds, seldom exceeds 2 feet above or below mean stage. In the section between Beaufort and the Cape Fear River the tidal range varies from 3.5 feet



at the inlets to 1 foot at points between. The tidal range for New River varies from 3.5 feet at New River Inlet to 1 foot at the head of the marshes, and nothing at Tar Landing, 31 miles above. The mean range of tide in the section from Cape Fear River, N.C. to Little River, S.C. varies between 4.7 feet in Cape Fear River, 4 feet at intermediate inlets, and 2 feet at points midway between inlets.

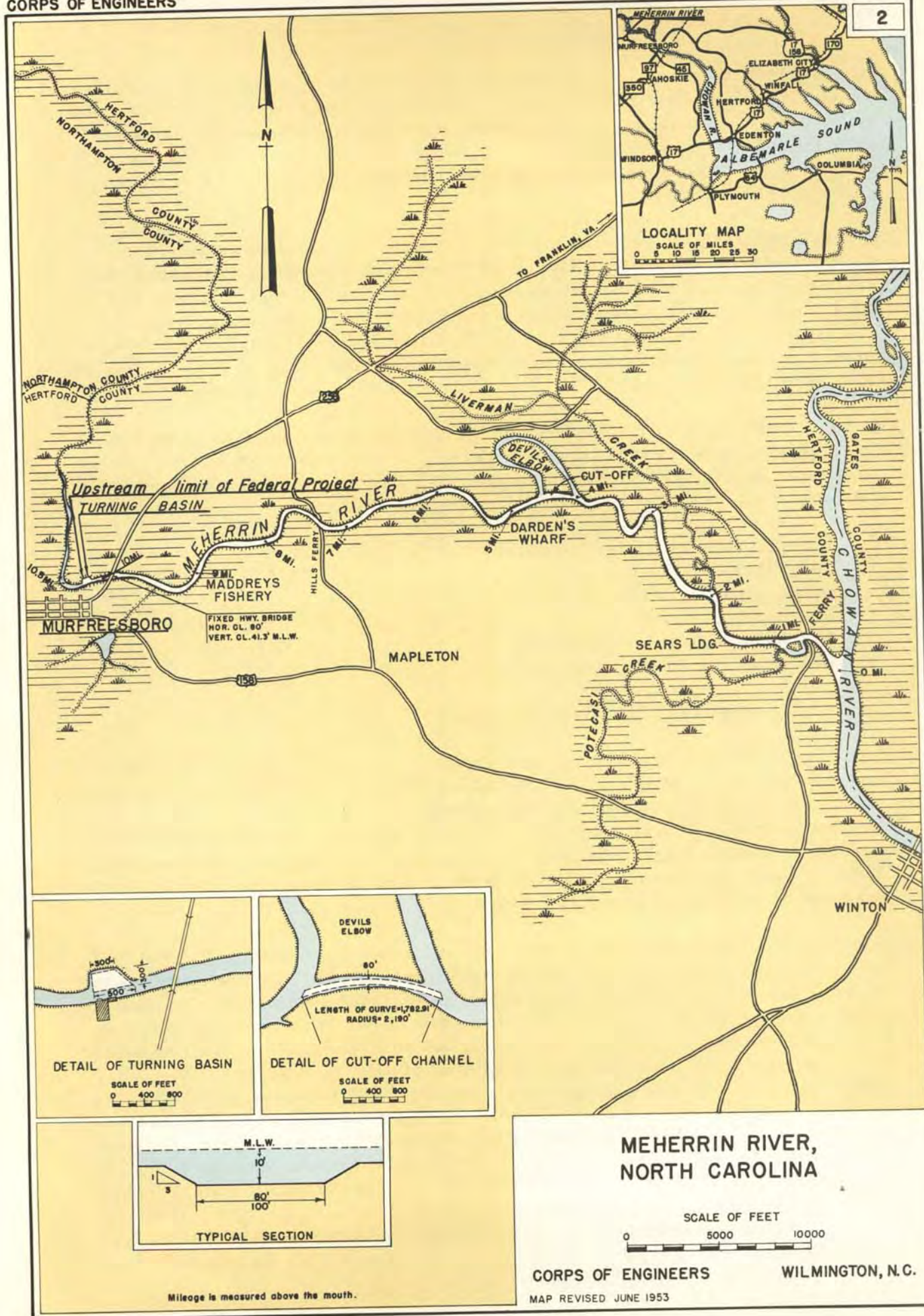
CONTROLLING DEPTH: Between the Virginia state line and Beaufort, N.C., 10.8 feet; Beaufort to Cape Fear River, 10.9 feet; side channel to Swansboro, 12.0 feet; channel in New River to Jacksonville, N.C., 8.0 feet; channel to New River Inlet, 3.5 feet; between Cape Fear River, N.C., and Little River, S.C., 9.7 feet; and in the yacht basin at Southport, 6.0 feet. (Shoaling resulting in lesser depths than the above were reported in the Mar. 6, 1954 Notice to Mariners, in the Cape Fear - Little River section, i.e., 7.0 feet).

COST OF CONSTRUCTION: \$9,600,507.47 to date which includes \$198,706.92 for new work under the previous projects. It was estimated in 1953 that an additional \$4,275,400 will be required to complete all work now authorized as follows:

Masonboro Inlet jetties (deferred)	\$ 1,590,000
Tidal lock in Snow Cut (deferred)	1,700,000
Masonboro Inlet channels	425,300
Six mooring basins	48,000
Fairfield (salt water intrusion)	195,000
New River to Jacksonville, N.C.	267,100
Total	<u>\$ 4,275,400</u>
Total exclusive of tidal lock and jetties	935,400

COST OF MAINTENANCE: \$6,910,900.53 to date, which includes about \$108,000 spent on previous projects. Maintenance is required every year and has averaged \$313,400 annually for the past ten year (1944-53). During fiscal 1953 only \$160,000 was spent, of which \$98,873 was for the operation and care of movable bridges spanning the waterway at Coinjock, Fairfield, Wilkerson Creek, Hobucken and Core Creek. About 147,000 cubic yards of material were dredged at a cost of \$54,725.

COMMERCE: During the 5 year period 1947-51 commerce averaged 1,201,080 tons annually, reaching 1,478,495 in the latter year. In 1952 the tonnage was 1,516,984 and in 1953 (preliminary data) 1,496,751. The major movement is pulpwood, logs and paper products, amounting to over two-thirds of the total. Petroleum products accounted for about 200,000 tons in 1951 (last detailed data available) and sand and gravel totaled about 140,000 tons. Menhaden and edible seafoods were important contributors (30,000 tons) as were sugar (15,000), corn (7000), soybeans (6000), fertilizer materials (26,000), chemical products (11,000) and numerous other commodities including automobiles, steel products, salt, machinery, etc. In 1951, about 665 up-bound and 760 down-bound pleasure craft used the waterway, most of which drew 6 feet or less. The total ton-miles accredited to this waterway (including the relatively small amount of traffic using the Jacksonville extension sub-project) was 103,494,650 in 1951, or an average haul of 70 miles within the project limits.



MEHERRIN RIVER

LOCATION: This waterway extends northwesterly from its mouth at the Chowan River about 39 miles above Albemarle Sound, to a turning basin just above the highway bridge at Murfreesboro.

PREVIOUS PROJECT: Adopted by R & H Act of Aug. 2, 1882.

EXISTING PROJECT: Authorized by the R & H Acts of Mar. 2, 1907; Aug. 30, 1935 and provides for a channel 10 feet deep from the mouth to turning basin at Murfreesboro, about 10.5 miles, with a cut-off channel through Devils Elbow, 4 miles above the mouth, 80 feet wide through cut-off, and 100 feet wide elsewhere; and a turning basin of the same depth, 300 feet wide and 500 feet long at Murfreesboro, the head of navigation.

PROGRESS: Completed in 1938.

VARIATION OF WATER SURFACE: The entire stream is nontidal, and except during freshets, its water surface rises and falls as winds raise or lower the water level of Albemarle Sound. Freshets cause variations of water level of from 3 to 4 feet in the navigable portion of the river.

CONTROLLING DEPTH: 8.5 feet at mean low water.

COST OF CONSTRUCTION: \$47,734.34

COST OF MAINTENANCE: Total of \$49,591.20 up to 1947. No maintenance work has been done since that time. It was estimated (in 1950) that \$20,000 should be spent in fiscal 1951 for maintenance dredging. No funds were provided.

COMMERCE: For the 10 year period 1942-51 annual tonnages have averaged about 15,200 with an apparent downward trend, dropping from 26,500 tons in 1942 to 7,925 in 1951. Except for an out-bound shipment of 560 tons of corn all 1951 traffic consisted of petroleum products (Gasoline and Kerosene) in-bound to Murfreesboro. Total ton-miles was 83,212 with an average haul equal to the project length, or 10.5 miles. Tows, consisting of a motor vessel and one oil barge, averaged about two trips per month. Most of the barges had loaded drafts of from 8 to 9 feet. The oil co., towboat drew about 7 feet.



NEWBEGUN CREEK

LOCATION: This creek rises in Pasquotank County and flows east about 5 miles to Pasquotank River, about 5 miles above its mouth in the northeastern part of Albemarle Sound.

PROJECT: Authorized by the R & H Act of March 2, 1919 and provides for an available depth of 5 feet at mean low water, and width of 40 feet, increased at entrances and on curves, across the bar at the mouth of the stream, a distance of about 3,000 feet. No improvement is authorized above the mouth of the creek.

PROGRESS: Completed in 1920.

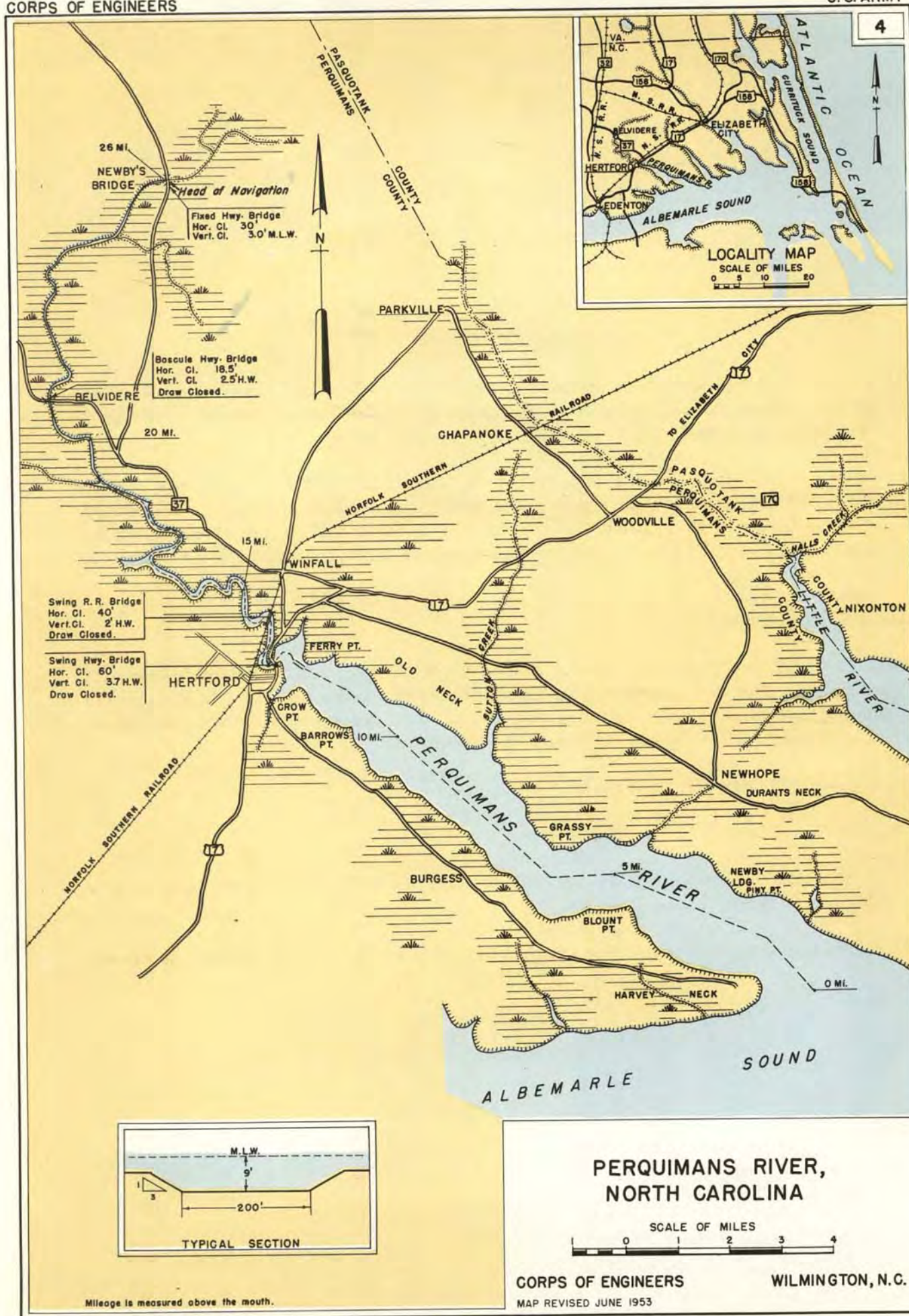
VARIATION OF WATER SURFACE: The stream is nontidal and except immediately after heavy rainfall the level of the creek varies with that of Albemarle Sound, which is largely influenced by wind, and unfavorable winds may cause variations of 2 feet above or below the mean level.

CONTROLLING DEPTH: 5.0 feet.

COST OF CONSTRUCTION: \$4,802.08

COST OF MAINTENANCE: \$246.58. No maintenance work has been done on this entrance channel since 1928.

COMMERCE: No commerce has been reported on Newbegun Creek in recent years.



PERQUIMANS RIVER

LOCATION: The approved project applies to only a short (1,000 ft.) reach of the Perquimans River, which connects Hertford with Albemarle Sound as a wide, 12 mile long estuary.

PROJECT: Authorized by the R & H Act of March 3, 1905 and provides for a channel 1,000 feet long and 200 feet wide and 9 feet deep at mean low water through the stumpy reach about 800 feet below Hertford.

PROGRESS: Completed in 1910.

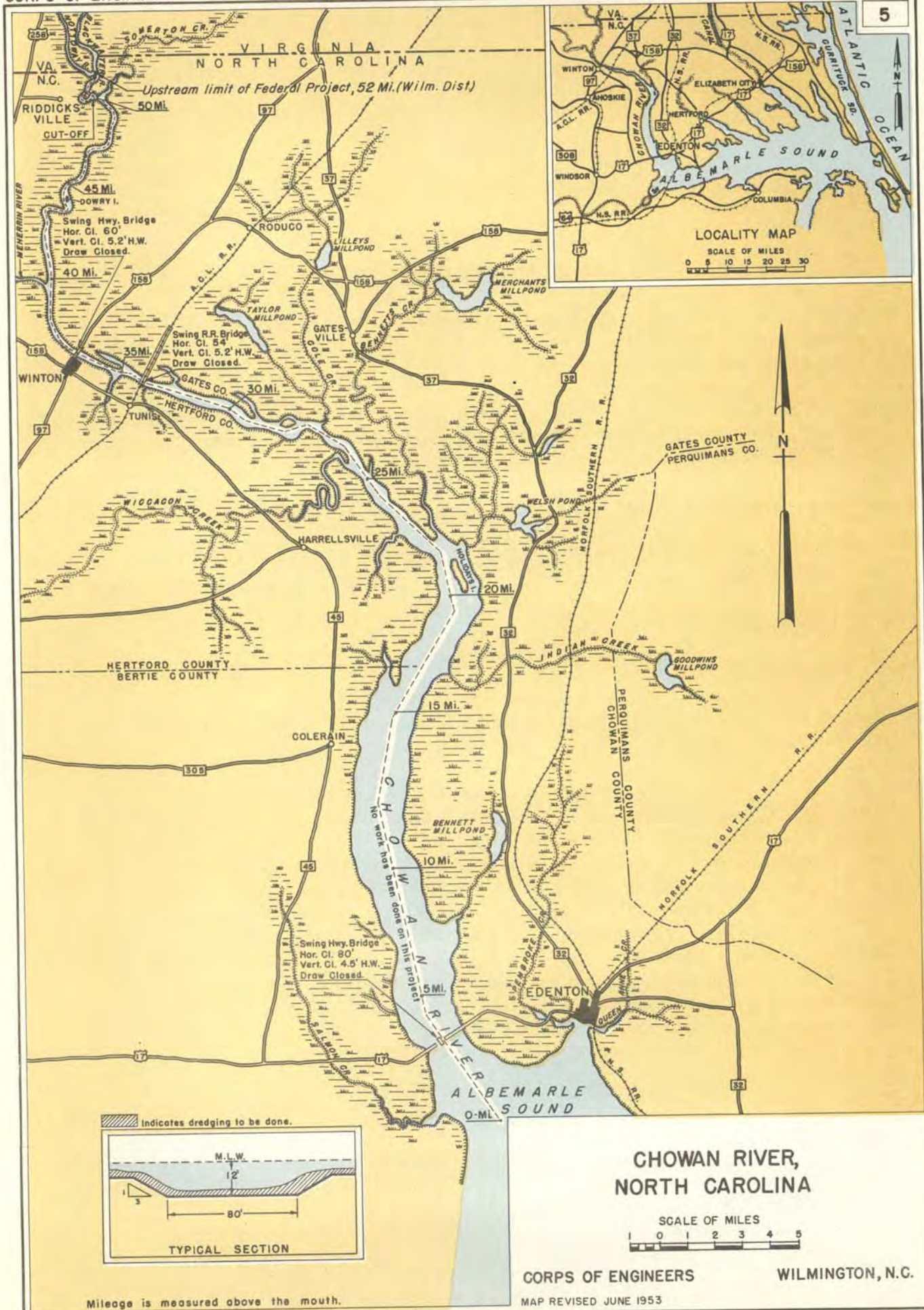
VARIATION OF WATER SURFACE: There is no lunar tide, the level of the surface of the water varying according to the direction and velocity of the wind.

CONTROLLING DEPTH: 9.0 feet.

COST OF CONSTRUCTION: \$13,750.00

COST OF MAINTENANCE: No maintenance has been done on this channel since it was completed in 1910.

COMMERCE: For the 10 year period 1942-51 annual tonnages have averaged about 10,000 with a maximum of 27,556 in 1942. For each of the past 5 years traffic has remained at about 8,000 tons with 8,529 during the last (1951) reported year, consisting entirely of petroleum products to Hertford. In computing traffic ton-miles (93,819) an 11 mile haul over the natural Perquimans River channel to Albemarle Sound has been accredited to this relatively short (1,000 ft.) project. Tows, consisting of a motor vessel and usually one oil barge, averaged about one round trip every 9 or 10 days. Although most barges were loaded to not over the controlling (and project) depth of 9 feet a few drawing 11 feet used the waterway, presumably during higher stages of short duration. Advance information indicates that 7254 tons moved in 1952 and 6455 in 1953. No details are as yet available.



CHOWAN RIVER

LOCATION: The Chowan River is a nontidal, fresh-water stream, formed by the Nottoway and Blackwater Rivers, both of which are entirely in Virginia, and have their confluence at the Virginia-North Carolina State line. From the confluence of the two streams the Chowan River flows south and southeast 52 miles to empty into the northwestern end of Albemarle Sound four miles west of Edenton, N. C.

EXISTING PROJECT: Authorized by the R & H Act of March 2, 1945 and provides for a channel 12 feet deep and 80 feet wide from the mouth to the confluence of the Nottoway and Blackwater Rivers, Va., including a cut-off channel of like dimensions through a sharp bend near Riddicksville, N. C. This authorization was based upon a 1938 review report which recommended improvement of the Chowan at an estimated cost of \$15,000 and also the Blackwater River to Franklin, Va., at a cost of \$120,000. (See House Doc. 101; 76th Cong., 1st Sess.). The present estimates are \$30,000 and \$323,800, respectively.

VARIATION OF WATER SURFACE: Nontidal.

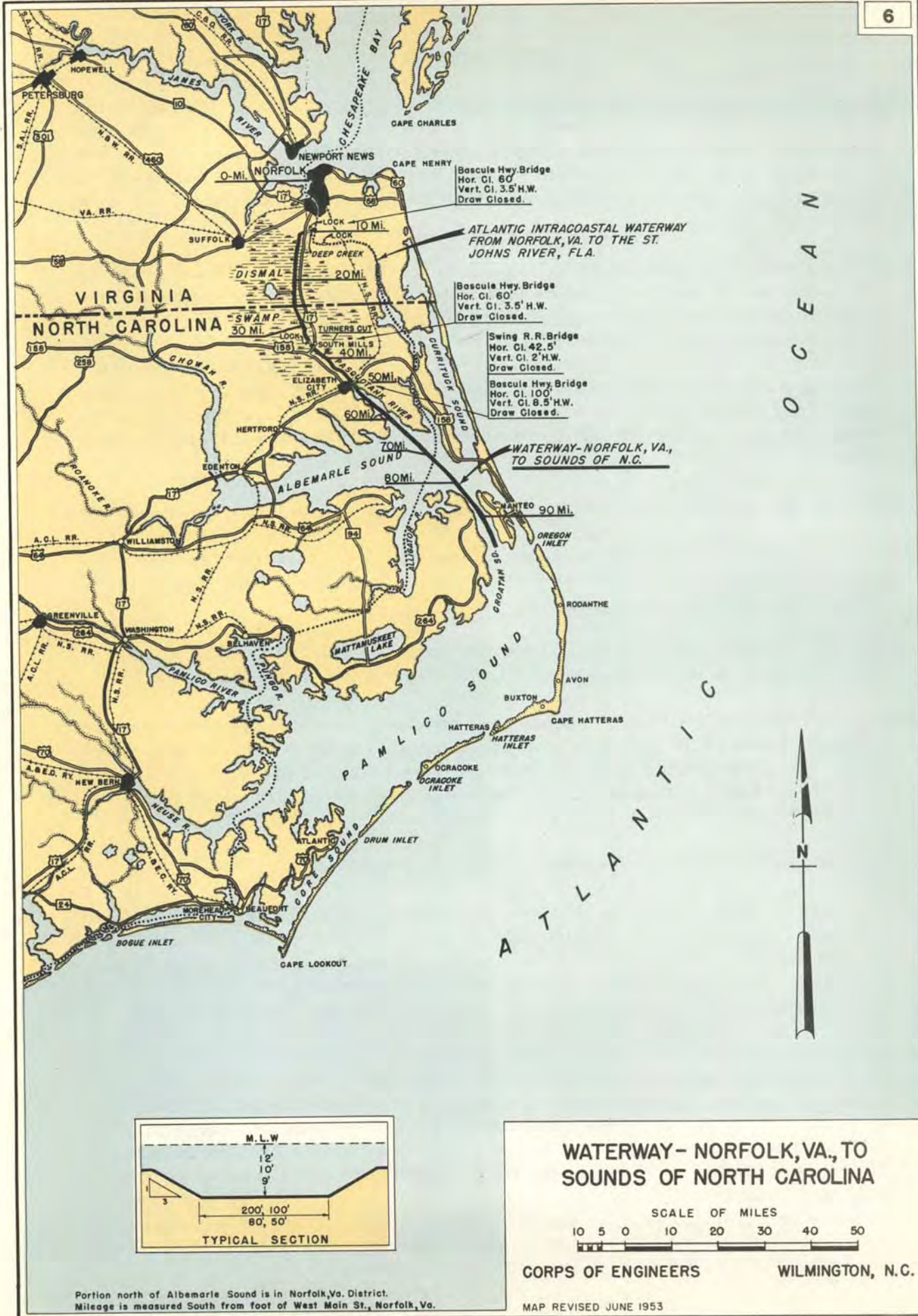
PROGRESS: No work has been done on the existing Chowan River project and none is in prospect until further studies can be made as to the needs of present and prospective commerce.

CONTROLLING DEPTH: 11.0 feet from the mouth to the head of the project at the confluence of the Nottoway and Blackwater Rivers, 52 miles above.

COST OF CONSTRUCTION: No expenditures have been made on the Chowan River project. (About \$100,000 has been spent to date on new work - mostly snagging - and maintenance of the Blackwater River since a previous project for that stream was adopted in 1878. The Blackwater project is under the jurisdiction of the U. S. District Engineer office at Norfolk, Va.).

COST OF MAINTENANCE: No expenditures.

COMMERCE: For the 5 year period 1947-51 commerce held fairly closely to an annual average of 72,660 tons but fell off to 56,855 tons in 1952 and to 47,829 in 1953. This is a marked decrease from that recorded during the last normal year (1939) before World War II, when a total of 155,192 tons were shipped, including 12,281 tons of rafted logs. Of the 1951 movements the last year for which details are available, 3620 tons consisted of upbound fresh fish(herring) from the lower Chowan and Albemarle Sound moving to processing plants at Colerain, Cannon's Ferry and other points within the official limits (52 miles) of the project. Through traffic in the amount of 7365 tons of petroleum products moved to Murfreesboro (See Meherrin River project) and 560 tons of corn originated at the latter point and moved to Baltimore. The major portion of the 1951 traffic consisted of 52,852 tons of out-bound pulpwood, about 20,000 tons of which went to Plymouth, N. C., and the remainder to Franklin, Va., on the Blackwater River. Total ton-miles in 1951 was 1,509,178 giving an average length of haul of 29.6 miles. Barges with maximum draft of 9 feet used the waterway.



WATERWAY-NORFOLK, VA., TO SOUNDS OF NORTH CAROLINA

LIMITS: This project serves as an alternate route, by way of the Dismal Swamp Canal, for the "Atlantic Intracoastal Waterway from Norfolk, Va., to the St. Johns River, Fla.," as treated under Project No. 1. The subject project extends south from its juncture with the Intracoastal Waterway, near the mouth of Pasquotank River, and connects with Croatan Sound.

EXISTING PROJECT: Authorized by the R & H Acts of Mar. 3, 1899; Mar. 3, 1925; June 26, 1934 and provides for dredging channels to depths of 10 feet at mean low water, over a least bottom width of 80 feet, in Deep Creek, Va.; Turners Cut, Pasquotank River, and Croatan Sound, N.C., and maintaining the Dismal Swamp Canal (which connects Deep Creek and Turners Cut) to a depth of about 9 feet over a bottom width of 50 feet. The limiting width of 80 feet applies to Turners Cut; the channels in Deep Creek and Pasquotank River have been dredged to depths of 10 feet over bottom widths of 100 feet, while the Croatan Sound Channel has been dredged to a depth of 12 feet over a bottom width of 200 feet. The project further provides for the protection of banks in Turners Cut with sheet piling, and cutting certain sharp points in Pasquotank River, in order to shorten its course. The two locks in Dismal Swamp Canal, Deep Creek, 10.7 miles from Norfolk, and South Mills, 33.1 miles from Norfolk, are each 52' x 300', lift 12 feet and have a depth of 12 feet on upper and lower miter sills. The active portion of the project (Deep Creek to and including Pasquotank River) is under the supervision of the Norfolk, Va. District.

PROGRESS: Completed in 1903. The Dismal Swamp Canal was acquired by the United States in 1929 from the Lake Drummon Canal and Water Co., for \$500,000.

VARIATION OF WATER SURFACE: Nontidal except in Deep Creek, where tidal range is 3 feet.

CONTROLLING DEPTH: Deep Creek, Va., 9.8 feet; Dismal Swamp Canal, 8.0 feet, (shoaling to a depth of 5 feet in the left outside quarter and 5.6 feet in the right outside quarter about 1.0 to 1.5 miles south of the Feeder Ditch was reported in the Mar. 6, 1954 Notice to Mariners); Turners Cut, 10.0 feet; Pasquotank River, 9.4 feet; and Croatan Sound, 10.0 feet.

COST OF CONSTRUCTION: \$751,196.46 to 1946, including \$500,000 for the purchase of the Dismal Swamp Canal; however, the 1940-41 replacement costs (about \$720,000) for the two Dismal Swamp Locks are not included since these were then carried under the Norfolk-St. Johns project. Since 1946 all work in the section from Norfolk to the mouth of the Pasquotank has been combined under the Norfolk-St. Johns project.

COST OF MAINTENANCE: The 1946 Annual Report of the Chief of Engineers indicates that to June 30th of that year the total cost of regular maintenance was about \$1,740,000. In addition over \$1,660,000 had been spent on the operation and care of the improvements (principally locks and draw spans). At that time about \$90,000 a year was required for the latter service. Since 1946 maintenance costs for the Dismal Swamp Route (exclusive of its extension south of the mouth of the Pasquotank) have been combined with those pertaining to the Virginia State portion of the Norfolk-St. Johns project. Thus combined, annual maintenance costs have averaged over \$450,000 for the period 1947-53.

COMMERCE: For the 5 year period 1947-51 commerce has averaged about 70,700 tons annually between Norfolk and the mouth of the Pasquotank. In the last year (1951) for which detailed information is available some 92,000 tons were moved. The principal commodities were: petroleum products (25,000 tons); logs (20,000 tons); grains (10,000 tons); sand and gravel (26,500 tons). In addition about 700 up-bound and 800 down-bound yachts and other pleasure craft used this waterway, almost all of which drew less than 6 feet (682 and 784 respectively). In 1952 the District Engineer at Norfolk was directed to prepare a study on this, and other waterways within his jurisdiction, with respect to the economic justification of its continued maintenance by the Federal Government. Since the economic returns of pleasure craft use is not readily susceptible to quantitative evaluation no ratio of costs to benefits could be derived and so far as can be determined no further action has been taken with a view to abandoning the Dismal Swamp Canal section of this project.



EDENTON HARBOR

LOCATION: This harbor is on the northerly side of Albemarle Sound near its westerly end, in front of the City of Edenton.

EXISTING PROJECT: Authorized by the R & H Acts of June 18, 1878; July 5, 1884; July 3, 1930 and provides for a channel 12 feet deep at mean low water over a bottom width of 150 feet between the 12-foot contour in Edenton Bay and the foot of Broad Street, Edenton, a distance of about 4000 feet, and channels of the same cross section, leading from the main channel, along the waterfront to the east and west.

PROGRESS: Completed in 1931.

VARIATION OF WATER SURFACE: The channel is nontidal. Variations of 1 foot or more in the water surface are due to winds.

CONTROLLING DEPTH: 6.9 feet as of June 1953; 8.0 feet in 1951; vessels drawing up to 10 feet used in the channel during the latter year.

COST OF CONSTRUCTION: \$73,750.00

COST OF MAINTENANCE: \$2,970.84. No maintenance work has been done since World War II. In 1949 it was estimated that \$20,000 would be needed to re-establish this channel.

COMMERCE: For the 5 year period 1947-51 commerce has averaged 12,900 tons annually with a high of 17,327 in 1947 and 12,052 reported for calendar year 1952. Advance data for 1953 shows a drop to 10,032 tons. The major portion of the total (12,161 tons) 1951 traffic consisted of inbound petroleum products (11,280 tons) from Norfolk, Va. About 360 tons of fresh fish were brought into Edenton from the Sound. 521 tons of fresh fruit moved out to Baltimore.



PEMBROKE CREEK

LOCATION: This creek extends from its mouth in Edenton Bay at Edenton some 9 1/2 miles to the north and northwest. The reach authorized for improvement is in effect merely an extension of the Edenton Harbor 12-foot channel project.

EXISTING PROJECT: Authorized by the R & H Act of March 2, 1945 and provides for a channel 12 feet deep at mean low water over a bottom width of 80 feet from the improved channel in Edenton Bay upstream 500 feet; thence 8 feet deep and 50 feet wide to the United States Fish Hatchery two-thirds mile above the mouth.

VARIATION OF WATER SURFACE: The stream is nontidal. Variations of 1 foot or more in the water surface are due to winds.

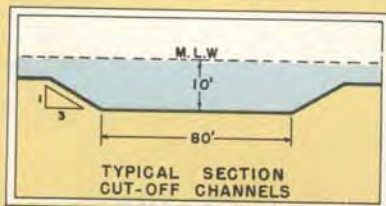
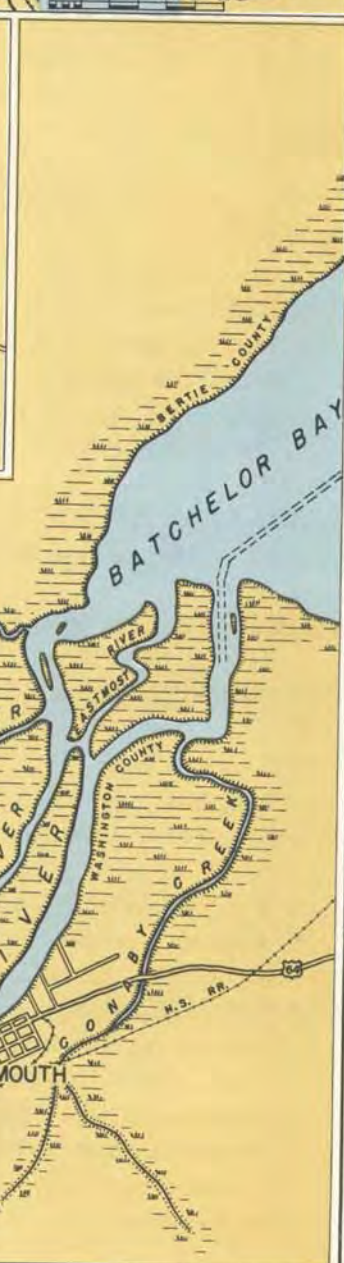
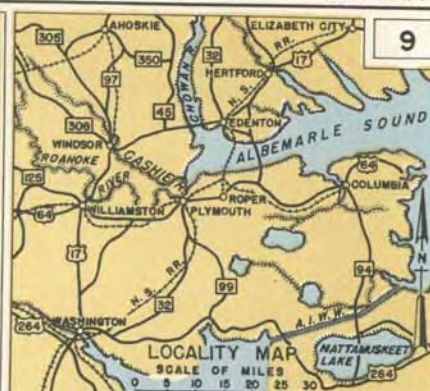
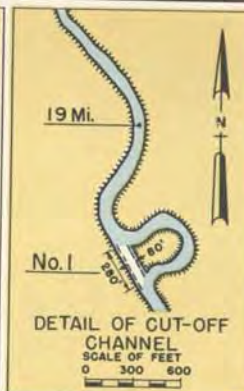
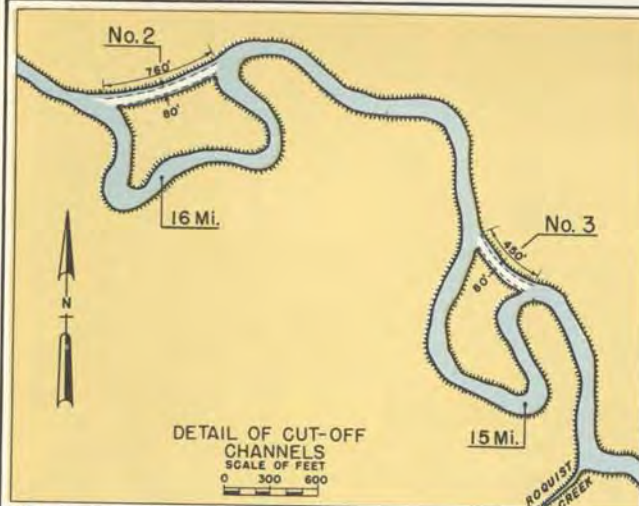
PROGRESS: No work has been done on the existing project.

CONTROLLING DEPTH: 4.0 feet.

COST OF CONSTRUCTION: None to date; the latest (1953) estimated cost is \$15,000. Local interests would be required to furnish suitable spoil-disposal areas for the initial work and for subsequent maintenance as required.

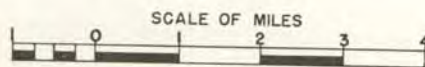
COST OF MAINTENANCE: None to date; the latest (1949) approved estimate for annual cost of maintenance is \$300.

COMMERCE: None reported to date. Available depths (minimum - 4.0 feet) accommodate small power boats based at the U. S. Fish Hatchery. (The U. S. Fish and Wildlife Service has recently, Mar., 1954, advised that it has under consideration the closure of this fish cultural station and inquired as to any interests the State may have in the station and its facilities).



Mileage is measured above the mouth of the Thoroughfare at Roanoke River.

CASHIE RIVER, NORTH CAROLINA



CORPS OF ENGINEERS

WILMINGTON, N.C.

MAP REVISED JUNE 1953

CASHIE RIVER

LOCATION: This river, a nontidal stream, rises in Bertie County, near Kelford, N. C., flows southeasterly about 57 miles to its intersection with the Thoroughfare (connecting Cashie with Roanoke Rivers) thence northeasterly about 7 miles, and empties into the extreme westerly end of Albemarle Sound. (Note that these last 7 miles are not a part of the authorized project).

EXISTING PROJECT: Authorized by the R & H Acts of July 3, 1930; August 26, 1937 and provides for the removal of logs, snags, and other obstructions between mouth of the Thoroughfare in the Roanoke River and Windsor, a distance of 20.5 miles; the construction of three cut-off channels 80 feet wide through sharp bends at points 1, 4, and 5 miles below Windsor, and a turning basin about 1.1 acres in area at Windsor, all to a depth of 10 feet.

PROGRESS: Completed in 1939.

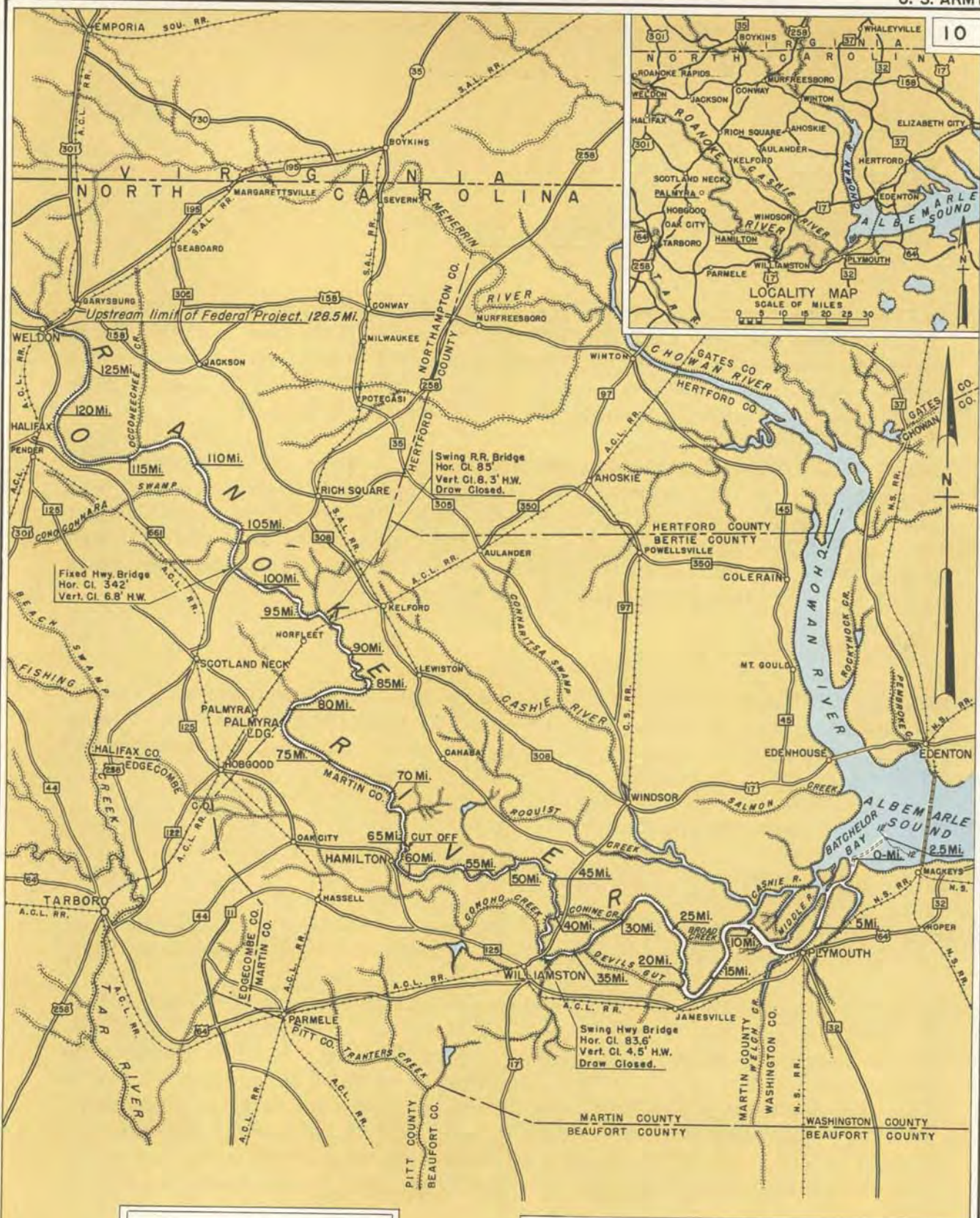
VARIATION OF WATER SURFACE: The river is not subject to floods or freshets, but its water surface rises and falls as winds raise or lower the water level in Albemarle Sound. The maximum fluctuation of the water surface is about 4 or 5 feet.

CONTROLLING DEPTH: 10.0 feet.

COST OF CONSTRUCTION: \$40,402.73

COST OF MAINTENANCE: \$15,458.05. No maintenance work has been done on this project since World War II except to make a condition survey in 1953.

COMMERCE: Traffic volume on this waterway has been dependent almost entirely upon pulpwood and logging operations along its improved reaches. Commerce reached a maximum of 66,852 tons in 1941 after which it consistently decreased to 1000 tons in 1950. Tonnages increased abruptly to 12,912 in 1951 and then to 14,375 in 1952, and according to advance data, to 27,600 tons in 1953, consisting almost entirely of pulpwood from loading points on the Cashie to Plymouth, N. C. About 4 tows a month moved consisting of a motor vessel drawing about 7 feet and a single barge with loaded draft of 6 foot or less.



Mileages are measured landward and seaward from the mouth.

CORPS OF ENGINEERS

WILMINGTON, N.C.

MAP REVISED JUNE 1953

ROANOKE RIVER

LOCATION: This stream rises in the Blue Ridge Mountains west of Roanoke, Va., and flows southeasterly about 200 miles to Clarksville, Va., where it is joined by Dan River, its principal tributary; thence in the same general direction about 200 miles and empties into the westerly end of Albemarle Sound. It has a drainage area of 9,630 square miles, of which 3330 lie in North Carolina.

EXISTING PROJECT: Authorized by the R & H Acts of Mar. 3, 1871; July 3, 1930; June 20, 1938 and provides for dredging a channel 12 feet deep and 150 feet wide from the 12-foot contour in Albemarle Sound into Roanoke River and thence upstream to a point about 1 mile above the town of Plymouth, N. C., a distance of 10 miles; thence a channel 10 feet deep and 100 feet wide to Hamilton, a distance of 53 miles; thence a channel 8 feet deep and 80 feet wide to Palmyra Landing, a distance of 18 miles, with a cut-off channel of like dimensions about 2 miles above Hamilton; thence a channel 5 feet deep and 50 feet wide to Weldon, N. C., a distance of 50 miles, by dredging, snagging, and regulation. (There is an existing Flood Control project, approved Dec. 22, 1944, for the comprehensive development of the Roanoke River Basin including the John H. Kerr Dam and 10 others).

VARIATION OF WATER SURFACE: The river is subject to freshets and rises and falls from 18 to 33 feet for about 70 miles below Weldon, but this fluctuation diminishes toward the mouth, the variation in water levels being from 1 to 2 feet in the lower 15 or 20 miles.

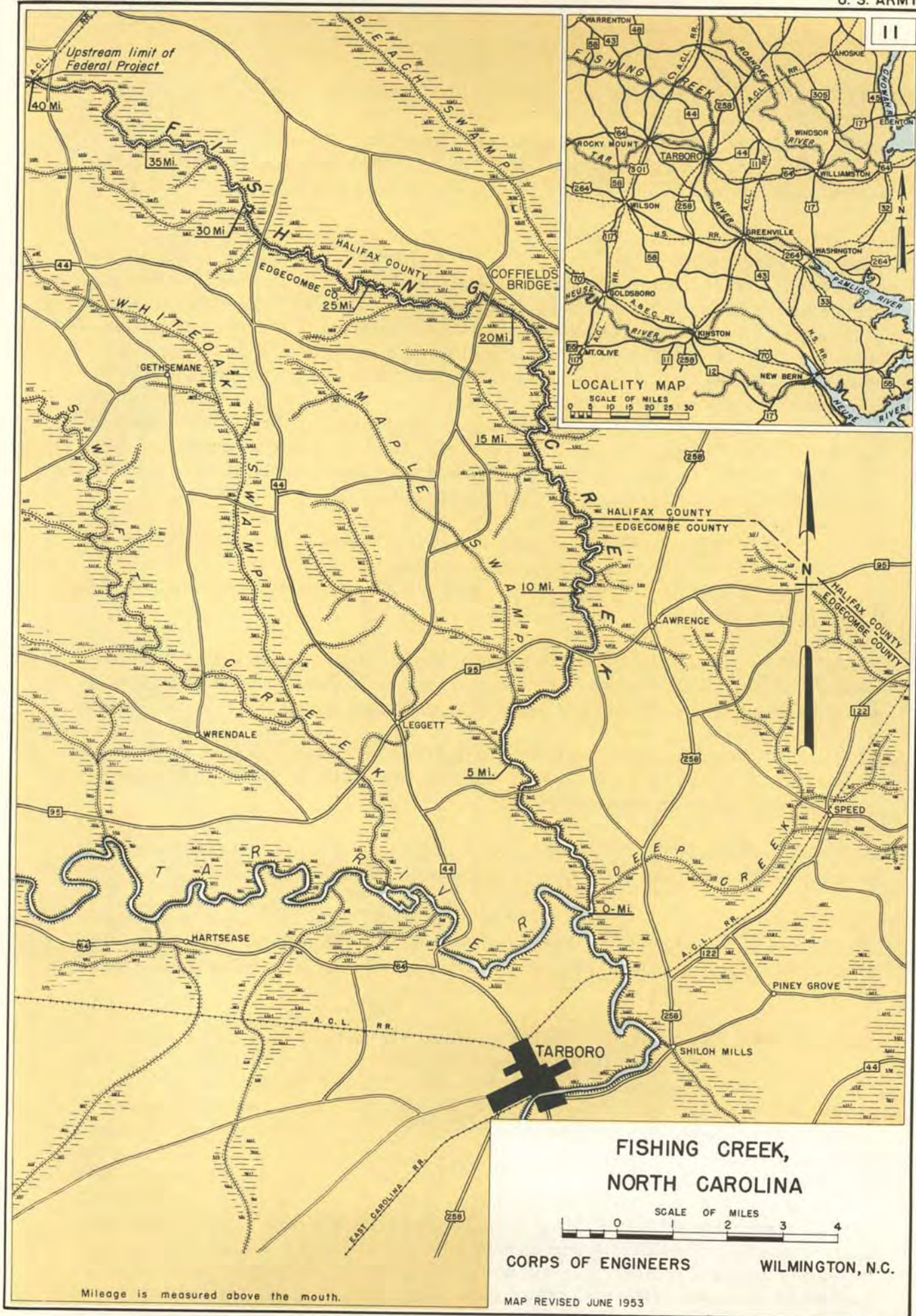
PROGRESS: The project to Palmyra Landing was completed in 1941. The percentage of completion above Palmyra Landing is uncertain as it is impracticable to obtain and maintain the project by dredging, snagging, and regulation.

CONTROLLING DEPTH: 10.2 feet between Albemarle Sound and 1 mile above Plymouth; 10.0 feet to Williamston; 7.6 feet to Hamilton; 2.4 feet to Palmyra Landing; and 1 foot to Weldon.

COST OF CONSTRUCTION TO DATE: \$404,584.34. The latest (1953) estimate to complete the project (to Palmyra only) is \$233,900.

COST OF MAINTENANCE: \$235,193.57 to June 1953. The last maintenance was done in 1948 consisting of snagging between Williamston and Palmyra Landing at a cost of about \$11,000. The 1953 estimate for annual cost of maintenance is \$30,000.

COMMERCE: For the past ten years commerce has held closely to an annual average of 300,000 tons, increasing somewhat in 1951 and 1952 to 392,000. Log rafting has gradually decreased from a high of 50,000 tons in 1941 to 6,200 tons in 1951. In that year some 185,000 additional tons of barged logs and pulpwood shipments originated on the Roanoke or came in from adjacent waterways (Chowan, Cashie or Scranton Creek) with the paper mill at Plymouth as the usual destination. Paper products in the amount of 100,000 tons moved out-bound via barge to Portland, Maine (6,400 tons) or by the Intra-coastal Waterway to Delair, New Jersey. Over 80,000 tons of petroleum products came in from Norfolk and 20,000 tons of fertilizer from Baltimore. The waterway was accredited with 12,001,758 ton-miles of traffic or an average haul of 30.5 miles. (Preliminary figures give 370,176 tons for 1953).



FISHING CREEK

LOCATION: Fishing Creek, the principal tributary to the Tar River with a drainage area of about 760 square miles, joins the latter from the north about 7 miles above the town of Tarboro.

EXISTING PROJECT: Authorized by the R & H Act of Sept. 19, 1890 and provides for a channel with a minimum width of 40 feet and a minimum depth of 20 inches at low water by the removal of logs, snags, trees, etc., from the mouth to the Atlantic Coast Line R. R. bridge 40 miles above. The length of section under improvement is 40 miles.

PROGRESS: The project was completed in 1901; since which time work has been confined to maintenance below Coffields Bridge, 21 miles above the mouth. No maintenance work has been performed for the last 10 or 15 years. Abandonment of this project was recommended to Congress in 1926 (House Doc., 467, 69th Cong., 1st Sess.).

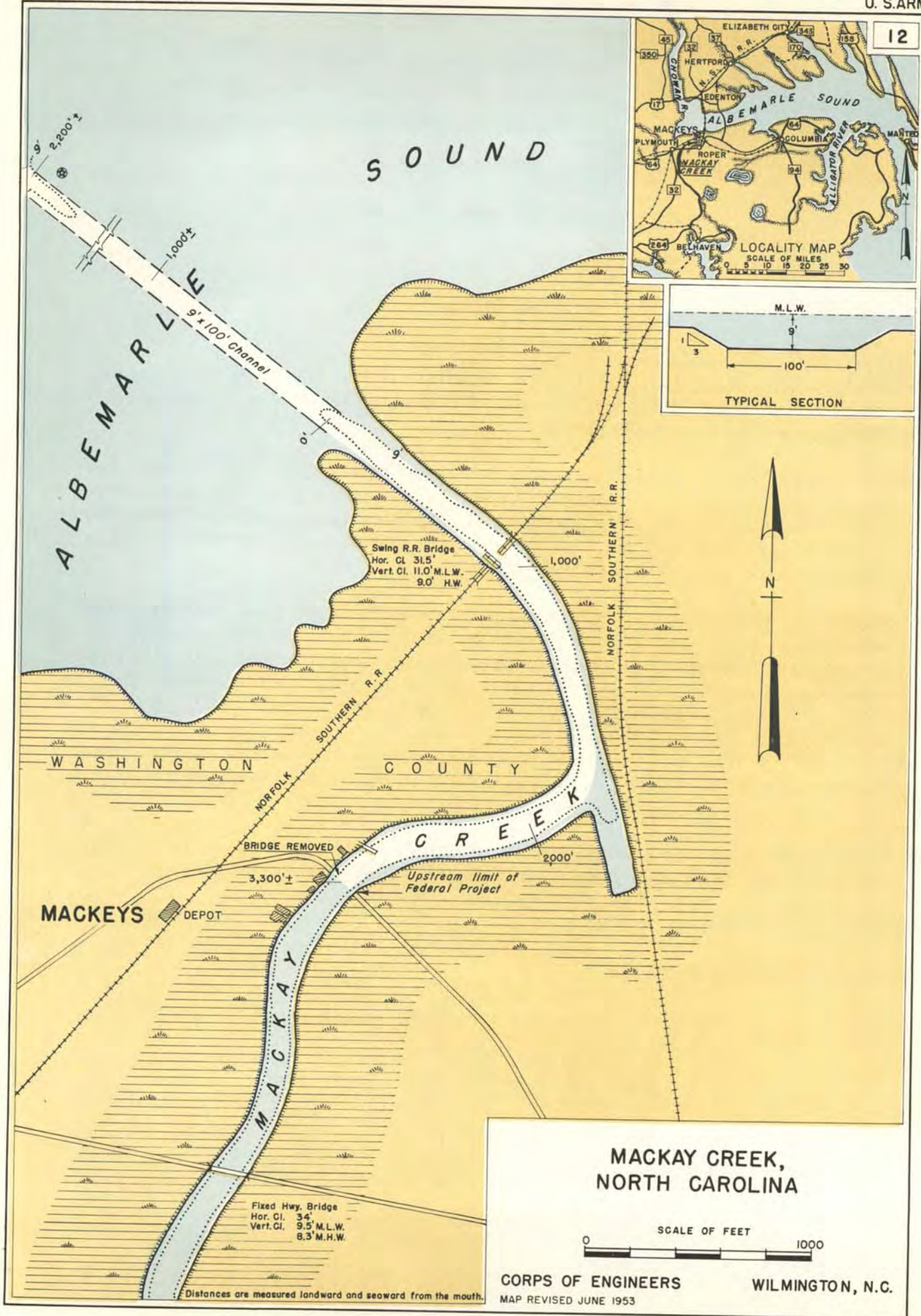
VARIATIONS OF WATER SURFACE: There is no lunar tide on this stream. The water surface varies from a minimum depth of 6 inches at extreme low water to 20 feet during high freshet stage.

CONTROLLING DEPTH: The stream is seriously obstructed at a point 2 miles above the mouth, and in poor to bad condition above this point.

COST OF CONSTRUCTION: \$22,715.10

COST OF MAINTENANCE: \$8,632.85

COMMERCE: No commerce has been reported on Fishing Creek since about 1918.



MACKAY CREEK

LOCATION: This is a short stream flowing north into the western end of Albemarle Sound about 5 miles east of the mouth of Roanoke River. Only the 5/8 of a mile reach to the old bridge (now removed) leading to Mackeys is included in the authorized project.

EXISTING PROJECT: Authorized by the R & H Acts of Sept. 19, 1890; July 3, 1930 and provides for a channel 9 feet deep at mean low water over a bottom width of 100 feet from deep water in Albemarle Sound across the bar, a distance of 2200 feet, and for removal of obstructions between the sound and Mackeys, a distance of about 5/8 mile.

PROGRESS: Completed in 1932.

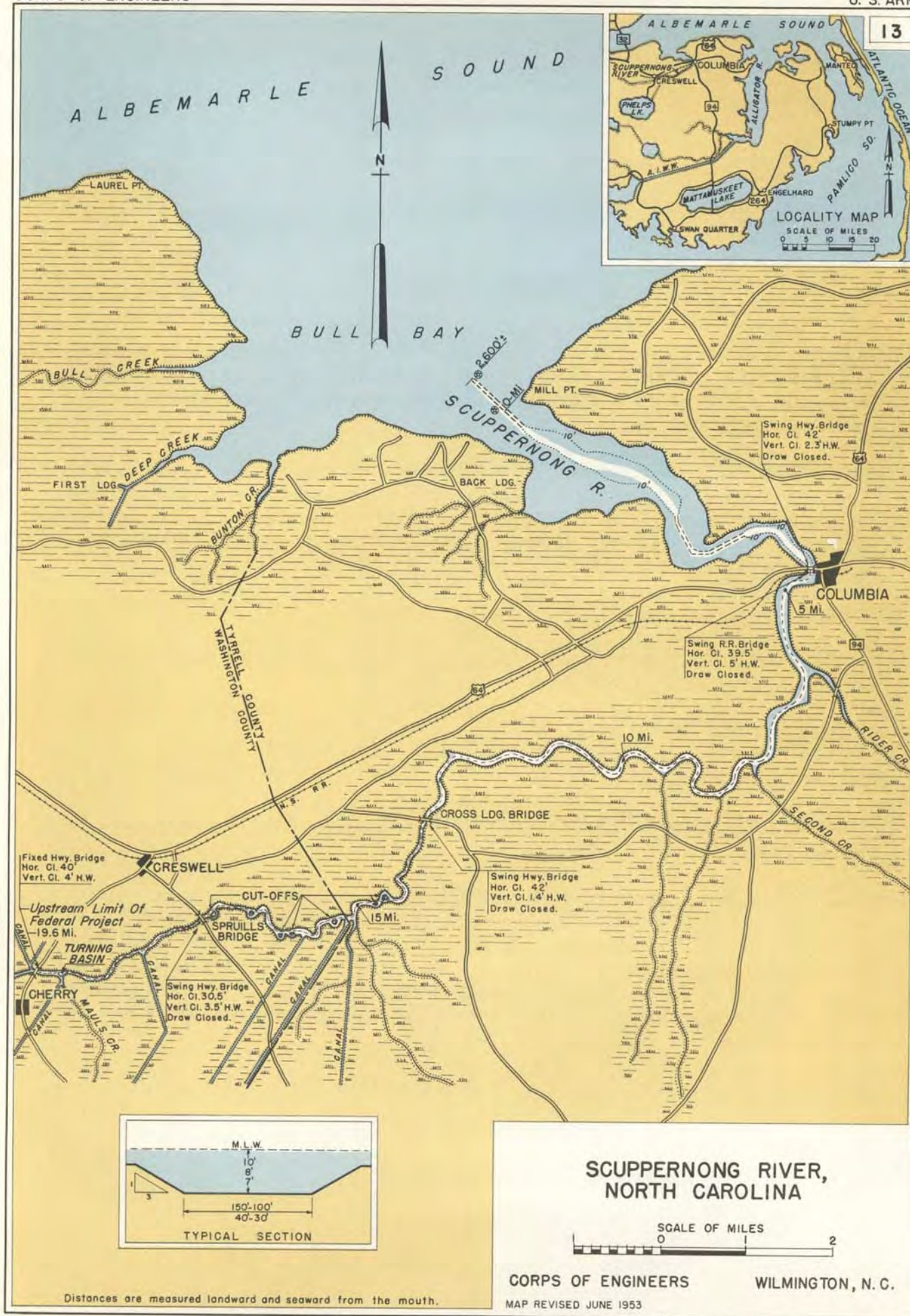
VARIATION OF WATER SURFACE: The stream is nontidal. Variations of 1 foot or more in the water surface are due to winds.

CONTROLLING DEPTH: 7.0 feet.

COST OF CONSTRUCTION: \$13,374.60

COST OF MAINTENANCE: \$4,773.03. No maintenance work has been done in recent years.

COMMERCE: Although commerce of 13,000 to 16,000 tons annually were reported in the late 1930's this consisted almost entirely of ferried automobiles to Edenton. Since 1939 when the new State Highway Bridge across Albemarle Sound (Route 32) was put into operation commerce on this waterway has gradually decreased from 5353 tons (1940) to 615 tons in 1952, and 971 tons in 1953. Only fresh fish cargoes to Mackeys from the sound have been reported in recent years.



SCUPPERNONG RIVER

LOCATION: This river rises in the center of the peninsula between Albemarle and Pamlico Sounds. It flows generally northerly, making a long bend eastward to the town of Columbia, then turning westward again until it flows into Albemarle Sound.

PREVIOUS PROJECTS: Adopted by the R & H Acts of Mar. 3, 1879 and June 13, 1902.

EXISTING PROJECT: Authorized by the R & H Act of March 2, 1919 and provides for a channel 10 feet deep and 150 feet wide on bottom across the bar; thence 10 feet deep and 100 feet wide on bottom up to and in front of the town of Columbia; thence 8 feet deep and 40 feet wide on bottom to Spruills Bridge, near Creswell, including six cut-offs; thence 7 feet deep and 30 feet wide on bottom to the highway bridge near Cherry; and a turning basin 7 feet deep, of a triangular form 150 feet wide on a side, near Cherry Bridge, at the mouth of Mauls Creek. The total length of channels included in the project is about 20 miles.

PROGRESS: Completed in 1925.

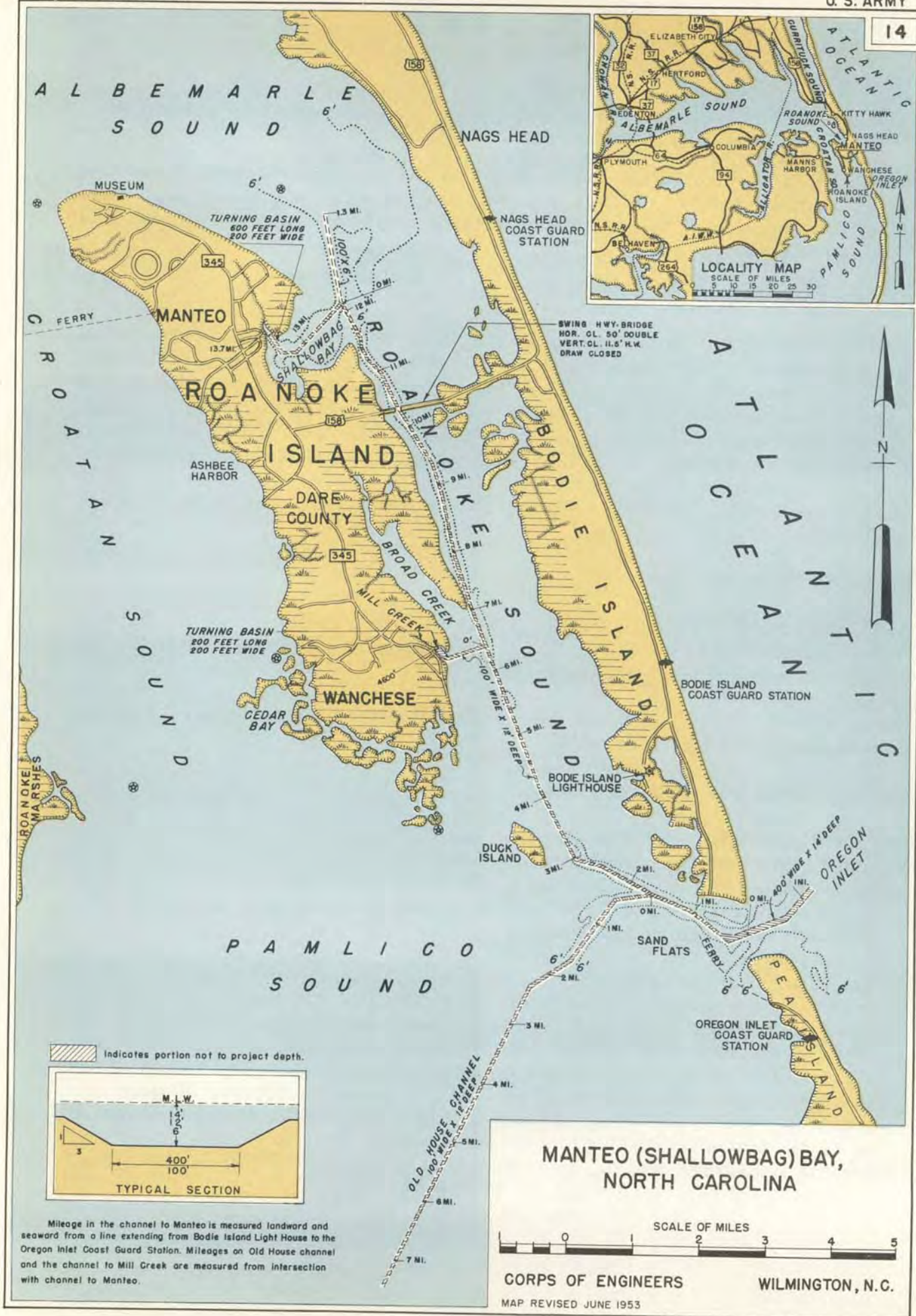
VARIATION OF WATER SURFACE: Nontidal. The oscillations of the surface being controlled by the winds, which cause ordinary variations of 1 foot. The extreme range of wind tides is 5.1 feet.

CONTROLLING DEPTH: 10.0 feet from the mouth to Columbia; 8.0 feet to Spruills Bridge; and 3.5 feet to Cherry.

COST OF CONSTRUCTION: \$59,914.95

COST OF MAINTENANCE: \$76,846.73 to date. The last maintenance work was done in late 1948 by contract dredging when 48,461 cubic yards were removed from shoals in the channel below Columbia at a cost of \$21,980.92. In 1949 it was estimated that \$18,000 would be needed to restore project depths. Present costs would be much higher.

COMMERCE: After reaching a high of about 34,000 tons in 1941 traffic decreased to 4840 tons in 1946. After leveling off at about 20,000 tons annually for the three year period of 1948-50 commerce increased sharply in 1951 to 86,000 tons. A major portion of this 1951 increase consisted of sand and gravel (57,000 tons) inbound to Columbia for road work in that vicinity. About 12,000 tons were logs outbound to Camden Mills, Va., and 16,000 tons of petroleum products to Columbia. Only 125 tons of other commodities (fresh fish) moved in 1951. A total of 70,044 tons were carried by this waterway in 1952, by vessels and barges drawing up to nine feet. Preliminary data for 1953 show only about one half that amount, or 35,658 tons.



MANTEO (SHALLOWBAG) BAY

LOCATION: Manteo Bay (also known as Shallowbag Bay since the days of Sir Walter's "Lost Colony") is a natural indentation on the northeastern side of Roanoke Island. Oregon Inlet, which marks the seaward limit of the official project, is the northernmost existing inlet of the Outer Banks.

EXISTING PROJECT: Authorized by the R & H Acts of June 25, 1910; Oct. 17, 1940; May 17, 1950 and provides for a channel 14 feet deep and 400 feet wide from the Atlantic Ocean over the bar and through Oregon Inlet, thence 12 feet deep and 100 feet wide via Old House Channel to that depth in Pamlico Sound; a channel 12 feet deep and 100 feet wide from Oregon Inlet to and including a turning basin 12 feet deep, 200 feet wide, and 600 feet long at Manteo; a side channel 12 feet deep and 100 feet wide from the Manteo-Oregon Inlet Channel in Roanoke Sound to wharves in Mill Creek near Wanchese, including a turning basin 200 feet square; and a connecting channel 6 feet deep and 100 feet wide from the Manteo-Oregon Inlet Channel in Roanoke Sound to that depth in Albemarle Sound. The total length of channels included in the project is about 25 miles. (See House Doc. 310, 81st Cong., 1st Sess.).

VARIATION OF WATER SURFACE: Variations of the water surface at Manteo are due to winds and seldom exceed 2 feet above mean stage. The extreme range of wind tides, determined by 1 year gage readings at Manteo, is 5.1 feet. The mean range of tide at Oregon Inlet is 1.8 feet.

PROGRESS: The existing project is 5 per cent complete. The 6-foot channel from Roanoke Sound to Manteo was dredged in 1911; the 6-foot channel from Manteo to Oregon Inlet was completed in 1941. No work has been done on providing the 14-foot channel over the ocean bar and through Oregon Inlet; the 12-foot channel to Pamlico Sound; the 12-foot channel from Oregon Inlet to Manteo; and the 12-foot side-channel from the Manteo-Oregon Inlet channel to Mill Creek near Wanchese.

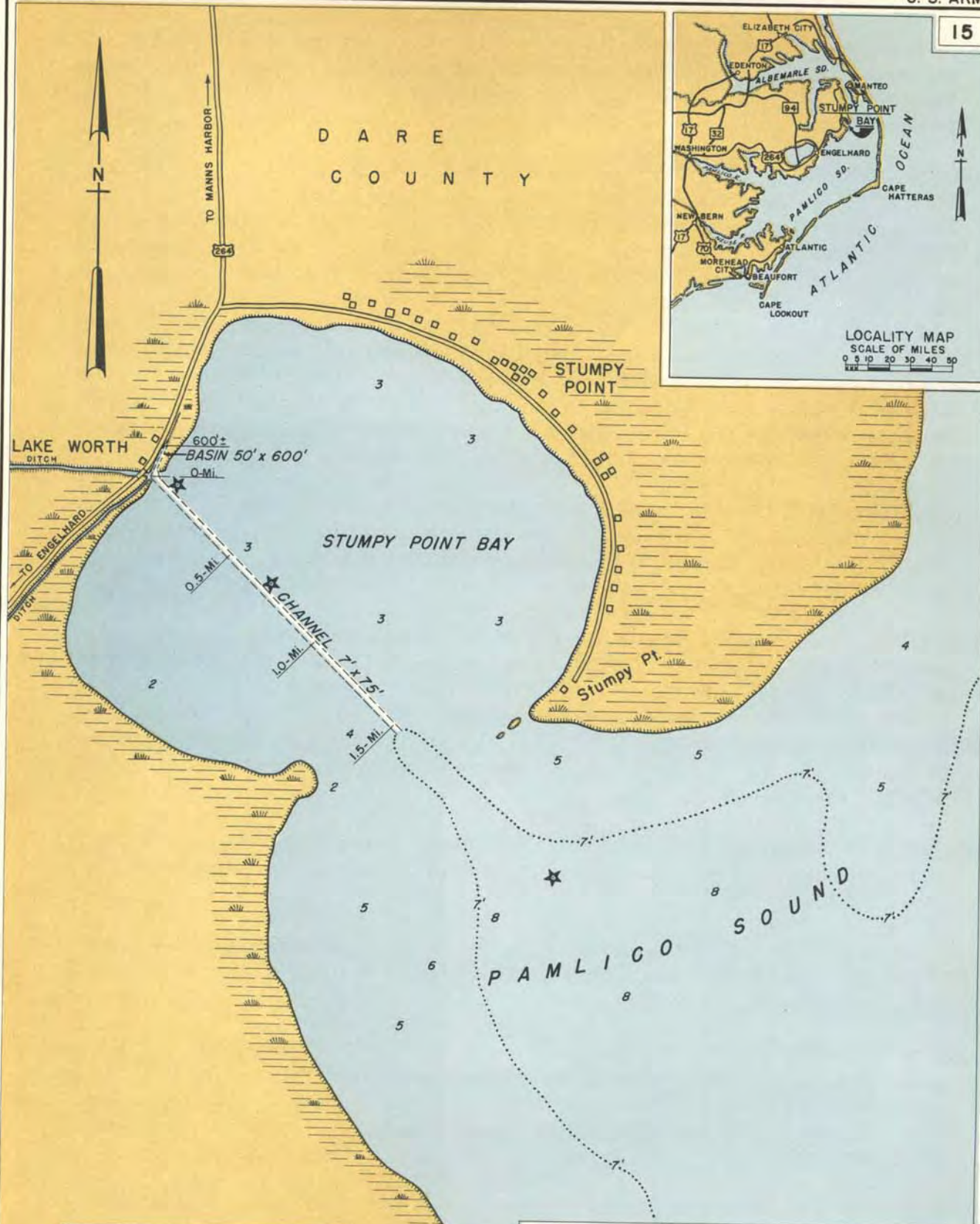
CONTROLLING DEPTH: 6.0 feet from Albemarle Sound to Manteo and 6.0 feet from Manteo to Oregon Inlet. (Prior to 1953 dredging controlling depth was about 3.0 feet.)

COST OF CONSTRUCTION TO DATE: \$63,383.84; no expenditures for new work have been made since 1941. Last (1953) estimate of funds needed to complete the project was \$1,104,800.

COST OF MAINTENANCE: To June, 1953 was \$159,897.46. About \$47,000 was spent in Aug., 1948 for dredging 131,000 cubic yds. of shoaling and \$25,000 in June, 1953 for removing some 60,000 yds. in the Manteo-Oregon Inlet Channel. The latest (1953) approved estimate of annual cost of maintenance is \$122,000.

COMMERCE: Total average annual commerce has been about 16,800 tons during the 5 year period 1947-51. In 1951 traffic amounted to 15,729 tons all but about 340 (fish and shellfish) of which consisted almost entirely of petroleum products, inbound (11,000 tons) from Norfolk and 4400 tons outbound to Engelhard. In 1952 commerce dropped to 15,000 tons, again practically all petroleum products except 378 tons of fish and shellfish. Although a few motor vessels with drafts up to 7 or 8 feet use these channels during favorable stages there is little doubt but that many more fishing boats would use them if and when the authorized project is completed. Preliminary 1953 data shows a total of 13,917 tons but details are unavailable.

15



STUMPY POINT BAY, NORTH CAROLINA

SCALE OF FEET
1000 0 1000 3000 5000

CORPS OF ENGINEERS

WILMINGTON, N.C.

MAP REVISED JUNE 1953

Distances are measured from landward end of Stumpy Point Bay channel.

STUMPY POINT BAY

LOCATION: Stumpy Point Bay is a circular indentation 2 miles in diameter on the mainland side near the northerly end of Pamlico Sound.

EXISTING PROJECT: Authorized by the R & H Act of June 30, 1948 and provides for a channel 7 feet deep at mean low water, 75 feet wide and about 8000 feet long, from the 7-foot contour in Pamlico Sound through Stumpy Point Bay to Lake Worth, with a boat basin, same depth, 50 feet wide by 600 feet long, at the inner end.

PROGRESS: Completed in June, 1950.

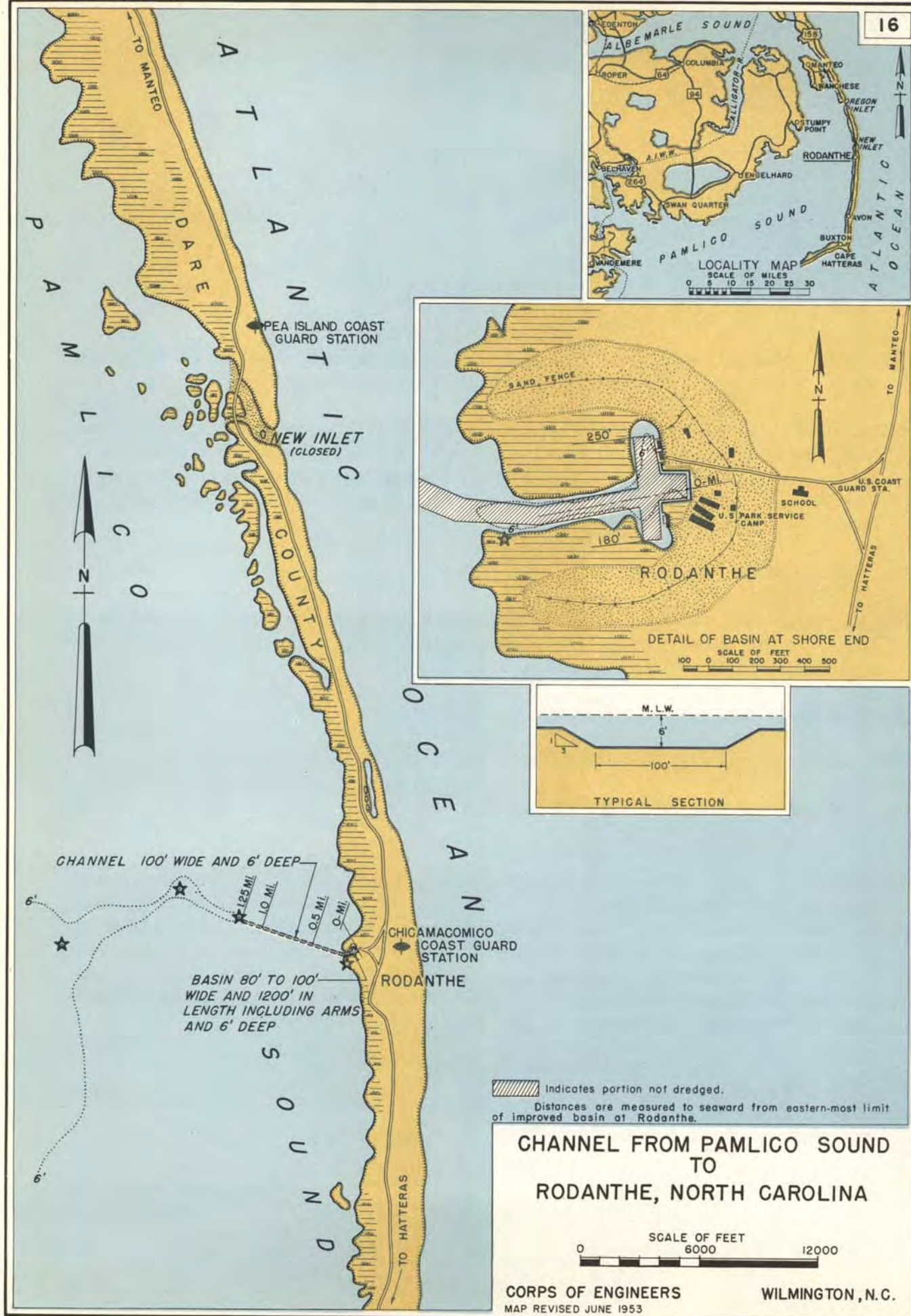
VARIATION OF WATER SURFACE: Lunar tides are imperceptible. Normal variations in the water surface due to wind action seldom exceed 1 foot, but may be as much as 5 feet during severe storms.

CONTROLLING DEPTH: 5.2 feet.

COST OF CONSTRUCTION: \$40,582.82

COST OF MAINTENANCE: None except \$122.30 for a condition survey in fiscal 1953.

COMMERCE: No commerce was reported prior to 1950. In 1950, 266 tons moved followed by 328 in 1951 and 382 in 1952. This traffic was almost entirely fishing boats drawing up to 5 feet. Preliminary 1953 data shows an increase to 1193 tons. (Note: The 1948 Act of Authorization specifies, among other requirements, that local interests provide and maintain adequate terminal facilities with access thereto open to all on equal terms. These requirements have not, as yet, been met.)



CHANNEL FROM PAMLICO SOUND TO RODANTHE

LOCATION: The village of Rodanthe is on the narrow barrier beach, which separates Pamlico Sound and the Atlantic Ocean. It is about 25 miles north of Cape Hatteras and 15 miles south of Oregon Inlet. The main 6-foot depth contour in Pamlico Sound lies about 3 miles offshore (westward) at this locality, but at a point about opposite Rodanthe, a narrow slough, known locally as Pughs Channel, brings the 6-foot depth to within one mile of the beach.

PREVIOUS IMPROVEMENTS: In 1936-37 the U. S. Coast Guard dredged a channel about 1 mile long, 80 feet wide and 7 feet deep along the alignment of the presently authorized project, together with a basin about 130 feet long and 80 feet wide. The total cost of this work was \$23,000 of which \$5000 was for bulk-heading. The purpose of the channel was to serve Coast Guard stations and the U. S. Park Service installations on the Outer Banks in that vicinity, since no highways to Rodanthe were then in existence.

EXISTING PROJECT: Authorized by the R & H Act of March 2, 1945 and provides for a channel 6 feet deep, 100 feet wide, extending from the 6-foot contour in Pamlico Sound to the shore, with a basin at the shore end of the same depth, 80 to 100 feet wide, and having a total length, including arms, of about 1200 feet.

VARIATION OF WATER SURFACE: Lunar tides are imperceptible. Normal variations in the water surface due to wind action seldom exceed 1 foot, but may be as much as 5 feet during severe storms.

PROGRESS: No work has been done on the existing project.

CONTROLLING DEPTH: 4.5 feet.

COST OF CONSTRUCTION: None to date. The original (1938) Survey Report (House Doc. No. 234, 76th Cong., 1st Sess.) estimated that the relatively small amount of dredging needed to widen the Coast Guard channel from 80 to 100 feet and the enlarged basin would cost \$5000. Due to channel deterioration since that time, plus increased unit costs, the 1953 estimate is \$45,000.

COST OF MAINTENANCE: The 1949 estimate of required annual maintenance was \$2000, the same as in the original (1938) report, and is probably low based on 1954 unit costs.

COMMERCE: No commercial statistics prior to 1947 are available, but local interests claim that 19,500 tons of seafood and supplies were handled in 1936. The average annual tonnage for the 5 year period 1947-51 was 1950 tons; 1274 tons moved in 1952, principally fish, shellfish and petroleum products. Preliminary 1953 data indicate 1160 tons moved on this waterway.



BELHAVEN HARBOR

LOCATION: The town of Belhaven, in Beaufort County, is at the junction of Pantego Creek and Pungo River, about 11 miles above the mouth of the latter. Pungo River forms part of the Intracoastal Waterway.

PREVIOUS IMPROVEMENTS: It is reported that private interests spent about \$50,000 for dredging in Belhaven Harbor prior to adoption of the existing project.

EXISTING PROJECT: Authorized by the R & H Acts of July 3, 1930; June 20, 1938 and provides for a channel 12 feet deep at mean low water and 100 feet wide, extending from deep water in Pungo River to a point about 800 feet east of the highway bridge, with a turning basin 800 feet long and 300 feet wide at the upper end; and for the construction of timber breakwaters at the mouth of Pantego Creek. The 1938 Act authorized the breakwater. Local interests were required to construct a public terminal at a cost of about \$12,000. This terminal was leased and later (1948) sold to private interests.

PROGRESS: The 12-foot channel was completed in 1931; the breakwaters in 1940.

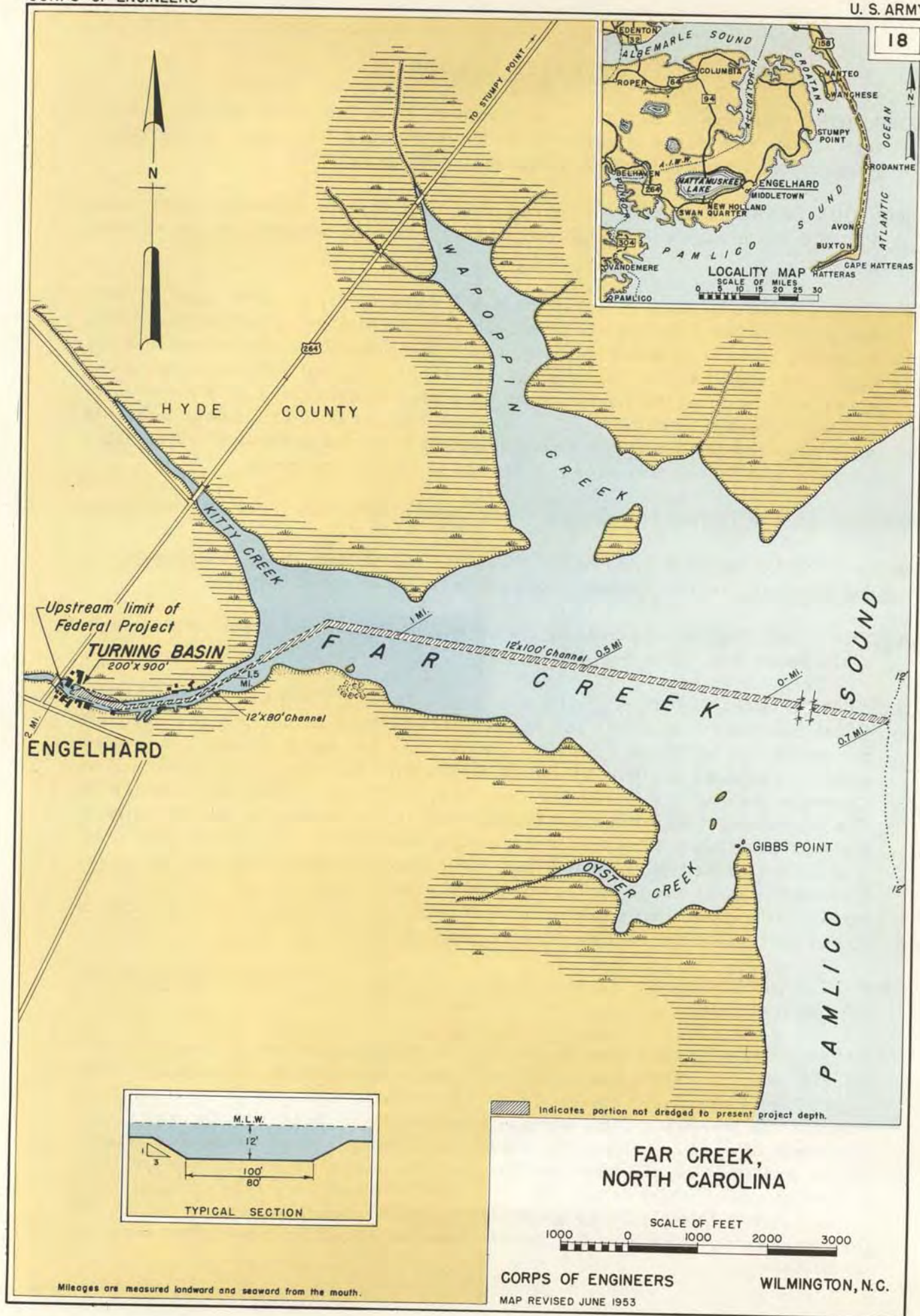
VARIATIONS OF WATER SURFACE: Nontidal. Variations in the water surface, due to winds, seldom exceed 2 feet above or below mean stage.

CONTROLLING DEPTH: Channel to Belhaven, 12.0 feet; and in the turning basin at the upper end, 10.3 feet.

COST OF CONSTRUCTION: \$126,687.41 of which about \$70,000 was for the jetties. Local interests claim that the timber breakwaters do not provide adequate protection for traffic in the harbor, especially for small vessels. A review report completed in 1948 by the U. S. District Engineer, and submitted to Congress Feb. 26, 1952 (House Doc. 389, 82d Cong., 2d Sess.) concurs in this claim but, based upon comparative costs, recommends the provision of a small-boat basin in Wynne's Gut rather than rebuilding the breakwaters. The estimated Federal cost was \$13,500 and non-Federal - \$6,250 for a public landing, spoil areas and removal of a small wooden bridge at East Front Street. It appears that some local opposition has developed to the closing of East Front Street necessitated by the proposed plan.

COST OF MAINTENANCE: \$2,447.75 to June, 1953. No maintenance work except miscellaneous surveys has been done since the war.

COMMERCE: During the 5 year period 1947-51 the average annual commerce was 19,710 tons. In 1951 a total of 17,487 tons were reported, principally rafted logs (7769 tons) from Slades Creek; petroleum products (6765 tons) from Norfolk and Morehead City; various seafoods (1903 tons) from the sound; and 1050 tons of oyster shells to the sound for planting. Total commerce reported for 1952 was 20,857 tons, and preliminary data show 17,117 tons for 1953, a breakdown of which is not yet available. Undoubtedly 1954 statistics will reflect the relatively large grain (corn and soybean) shipments by 25,000 bushel capacity barges to Baltimore from the recently constructed elevator at Belhaven.



FAR CREEK

LOCATION: Far Creek, about 4 miles long, flows east in Hyde County and enters Pamlico Sound as a wide and shallow estuary or bay. The town of Engelhard, head of navigation, lies about 2.3 miles above the mouth.

EXISTING PROJECT: Authorized by the R & H Acts of July 3, 1930 providing for a 7-foot channel (60 feet wide); and May 17, 1950 which provides for a channel 12 feet deep and 100 feet wide from that depth in Pamlico Sound along the general alinement of the existing channel through the wide section of the creek, and thence 12 feet deep and 80 feet wide to a point about 200 feet below the highway bridge at Engelhard, with a turning basin of the same depth with maximum width and length of about 200 feet and 900 feet, respectively, at the head. The total length of channels included in the project is about 2.7 miles.

VARIATIONS OF WATER SURFACE: There is some lunar tide in Pamlico Sound, but the principal variations in the level of the water surface are due to winds. Ordinary winds cause a variation of about 1 foot, while severe storms will double or triple this variation.

PROGRESS: The existing project is 16 per cent complete. The 7-foot channel from Pamlico Sound to Engelhard was completed in 1931. No work has been done on increasing the depth of the channel and turning basin to 12 feet.

CONTROLLING DEPTH: 7.0 feet from Pamlico Sound to Engelhard.

COST OF CONSTRUCTION TO DATE: \$34,500.00. The 1948 review report (House Doc. 770, 80th Cong., 2d Sess.) upon which the Authorizing Act of May 17, 1950 was based estimated \$80,600 would be required to complete the recommended enlargement. Later (1953) estimates have increased this figure to \$178,500.

COST OF MAINTENANCE: \$102,872.53 to June, 1953. The last maintenance dredging was done in May, 1952 when 50,000 cubic yds. were removed at a cost of about \$25,000 and resulted in a controlling depth of 7 feet. The latest (1953) approved estimate for annual cost of maintenance is \$21,000.

COMMERCE: Average annual water-borne commerce over this waterway for the period 1947-51 has been 29,640 tons, principally petroleum products and seafood with the exception of 61,000 tons of sand and gravel for road work in 1947 and 47,250 tons in 1950. Commerce in 1951, when no sand or gravel was transported, totaled 5,900 tons. In 1952 tonnages increased to 27,897 of which 26,186 tons were sand and gravel. Preliminary data for 1953 show a considerable increase in outbound tonnage to Baltimore consisting of grain (soybeans and corn), due to the initiation during the year of barge shipments from the Gibbs Elevator in Engelhard. Advance information indicates this grain movement exceeded 9000 tons. Petroleum products (about 2300 tons) and seafood (2000 tons) gives a total in excess of 13,000 tons for 1953. Due to the restricted depths (7 feet) the grain barges are loaded to less than 75 per cent of their normal 25,000 bushel capacity.



WATERWAY CONNECTING SWAN QUARTER BAY WITH DEEP BAY

LOCATION: This project consists of two parts: the connection between Swan Quarter Bay and Deep Bay and the entrance channel to the town of Swan Quarter, the county seat of Hyde County. By water Belhaven on Pungo River lies 26 miles northwesterly and Washington, N. C., 45 miles westerly. The town has no railroad connection.

PREVIOUS IMPROVEMENTS: A private canal was constructed in 1909 by local interests at a cost of about \$10,000 for the canal connecting the town with Swan Quarter Bay.

EXISTING PROJECT: Authorized by the R & H Acts of June 25, 1910; Mar. 2, 1945 and provides for a channel 60 feet wide and 8 feet deep from Deep Bay through the present waterway to Swan Quarter Bay, and thence through the Swan Quarter Canal to a basin of the same depth about 500 feet long, and 60 to 300 feet wide, at the head of the canal. Local interests were required to extinguish existing rights of the Canal Company.

VARIATION OF WATER SURFACE: Nontidal. Variations in the water surface due to wind action seldom exceed 1 or 2 feet above or below mean stage.

PROGRESS: The existing project is 28 per cent complete. The part of the project providing for a channel 5000 feet long, 50 feet wide, and 6 feet deep, through the marsh connecting Swan Quarter Bay with Deep Bay, was completed in 1911. No work has been done on the part providing for a channel 8 feet deep, 60 feet wide, from Deep Bay to and including a basin at the head of Swan Quarter Canal.

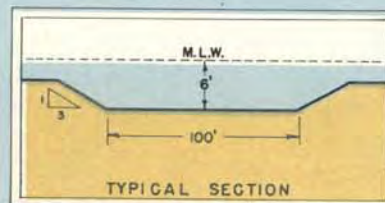
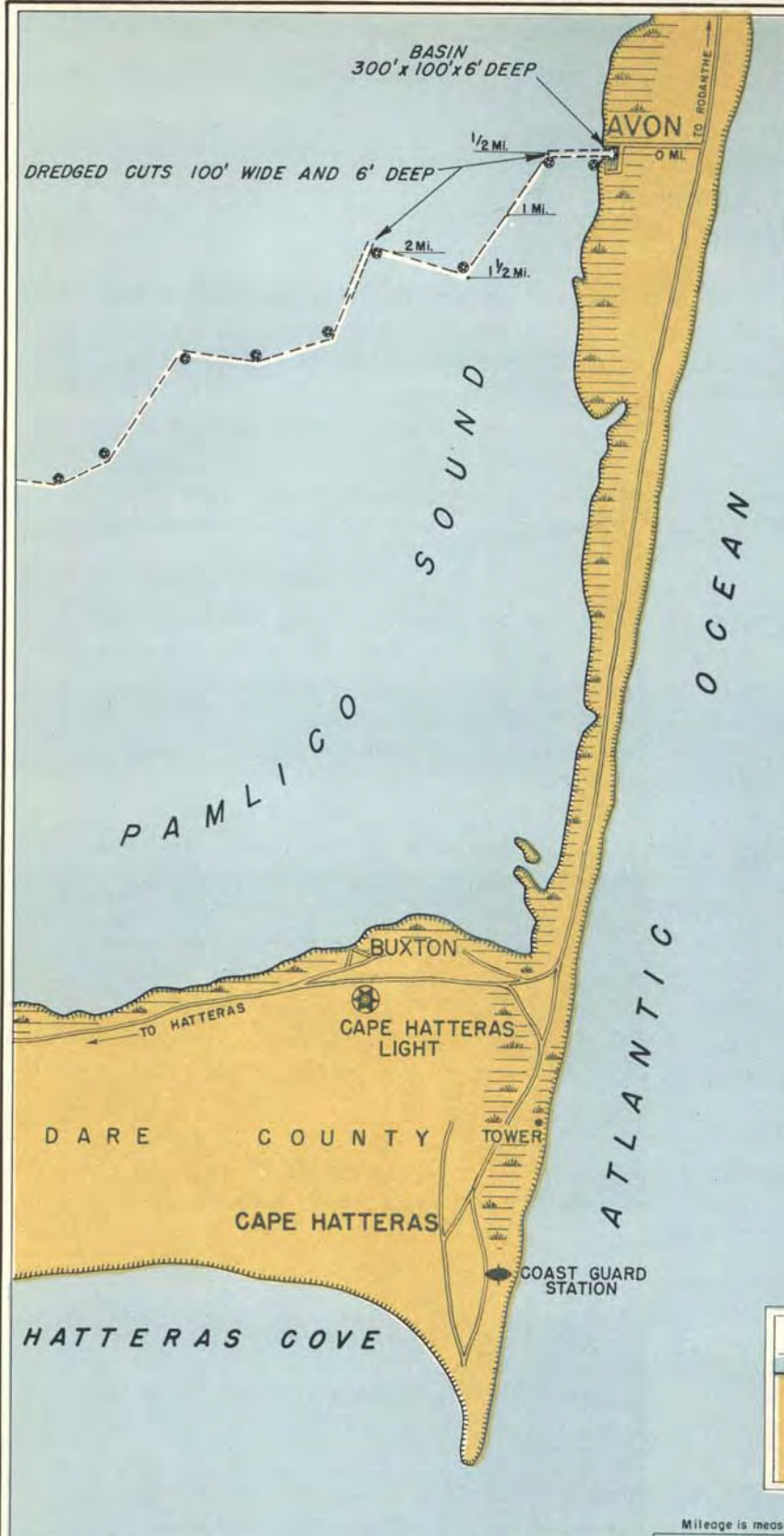
CONTROLLING DEPTH: 5.4 feet in the channel connecting Swan Quarter Bay with Deep Bay, and 5.7 feet in the Swan Quarter Canal from Swan Quarter Bay to Swan Quarter.

COST OF CONSTRUCTION TO DATE: \$8,550.98. It is estimated (1953) that \$50,000 will be required to complete this project.

COST OF MAINTENANCE: \$10,433.40. No maintenance work has been done for at least the past 20 years.

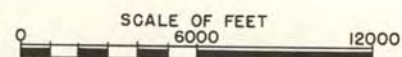
COMMERCE: Average for the five year period 1947-51 was about 2500 tons. It dropped to 771 tons in 1951 which consisted entirely of marine products including 120 tons of oyster shells. About 1360 tons moved in both 1952 and 1953, again principally marine products.

20



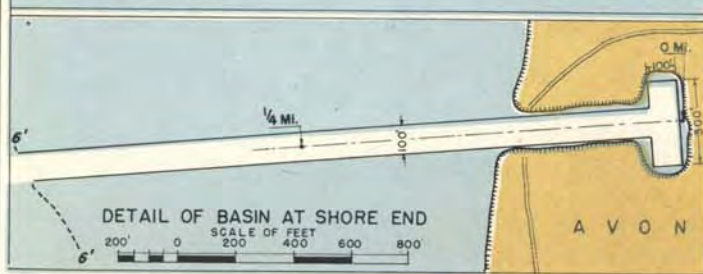
Mileage is measured seaward from easternmost limit of improved basin at Avon, N.C.

CHANNEL FROM PAMLICO SOUND TO AVON, NORTH CAROLINA



CORPS OF ENGINEERS
MAP REVISED JUNE 1953

WILMINGTON, N.C.



CHANNEL FROM PAMLICO SOUND TO AVON

LOCATION: The village of Avon is on the narrow barrier beach between Pamlico Sound and the Atlantic Ocean, 9 miles north of Cape Hatteras. West of the village the sound is 25 miles wide. About 4 miles offshore in the sound, a shoal or bar parallels the beach from Hatteras Inlet, 15 miles southwest of Avon, to Oregon Inlet, 30 miles north of Avon.

EXISTING PROJECT: Authorized by the R & H Act of March 2, 1945 and provides for a channel 6 feet deep and 100 feet wide, from Pamlico Sound to Avon, and a basin at the shore end of the same depth, 100 feet wide and 300 feet long.

PROGRESS: Completed in 1946.

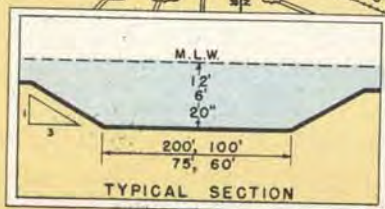
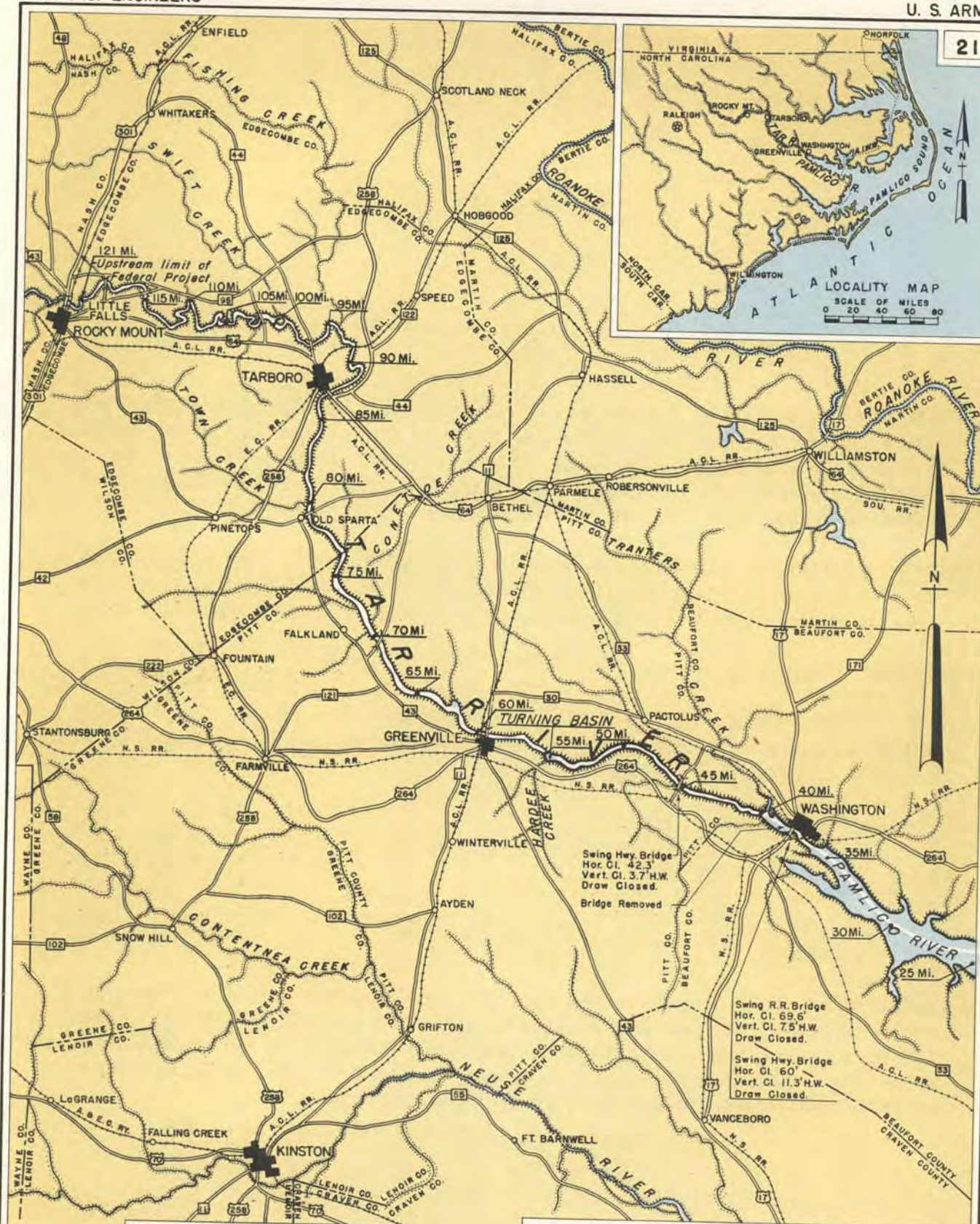
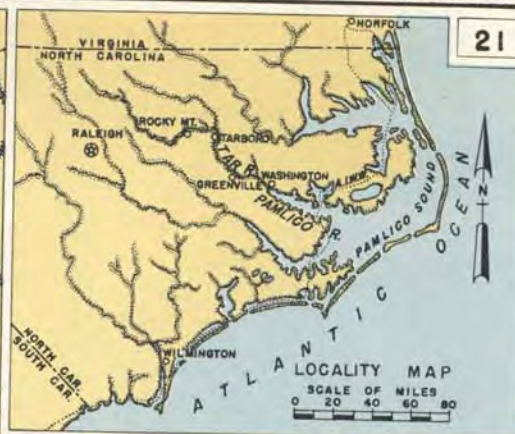
VARIATION OF WATER SURFACE: Lunar tides are imperceptible. Normal variations in water surface due to wind action seldom exceed 1 foot, but may be as much as 5 feet during severe storms.

CONTROLLING DEPTH: 6.0 feet.

COST OF CONSTRUCTION: \$28,000.00

COST OF MAINTENANCE: None except \$336.65 spent in fiscal 1953 for a condition survey.

COMMERCE: For the 5 year period 1947-51 commerce averaged 2050 tons annually and approximated that amount in both 1952 (2122 tons) and 1953 (2346 tons). Although the most important item was seafood there was considerable diversity in the other commodities moved such as coal, ice, building materials, miscellaneous freight and some petroleum products.



Mileage is measured above the mouth of Pamlico River.

PAMLICO & TAR RIVERS,
NORTH CAROLINA

SCALE OF MILES

CORPS OF ENGINEERS

WILMINGTON, N.C.

MAP REVISED JUNE 1953

PAMLICO & TAR RIVERS

LOCATION: The two names are applied to the same river, known as the Pamlico below Washington, N. C., and as the Tar above that point. This stream rises in Person County, is about 217 miles long and has a drainage area of some 3075 square miles.

PREVIOUS PROJECTS: Adopted by R & H Acts of July 4, 1836 and Aug. 30, 1852. About \$15,000 was expended.

EXISTING PROJECT: Authorized by the R & H Acts of Aug. 14, 1876; Mar. 3, 1879; Aug. 11, 1888; Mar. 2, 1907; July 25, 1912; July 3, 1930; Aug. 26, 1937 and provides for a channel 12 feet deep at mean low water and 200 feet wide from the 12-foot contour in the river below Washington to the Atlantic Coast Line Railroad bridge at Washington; 12 feet deep and 100 feet wide from Washington to a turning basin of the same depth, 200 feet wide and 300 feet long, in Hardee Creek, 1500 feet above its mouth; 6 feet deep and 75 feet wide to Greenville; 20 inches deep and 60 feet wide to Tarboro; thence to clear the natural channel above Tarboro to Little Falls. The length of section under improvement is 97 miles, extending from a point 14 miles below Washington to Little Falls. Abandonment of this project above Tarboro was recommended in 1927.

PROGRESS: The 12-foot channel below Washington was completed in July, 1931, and extended to Hardee Creek in 1939.

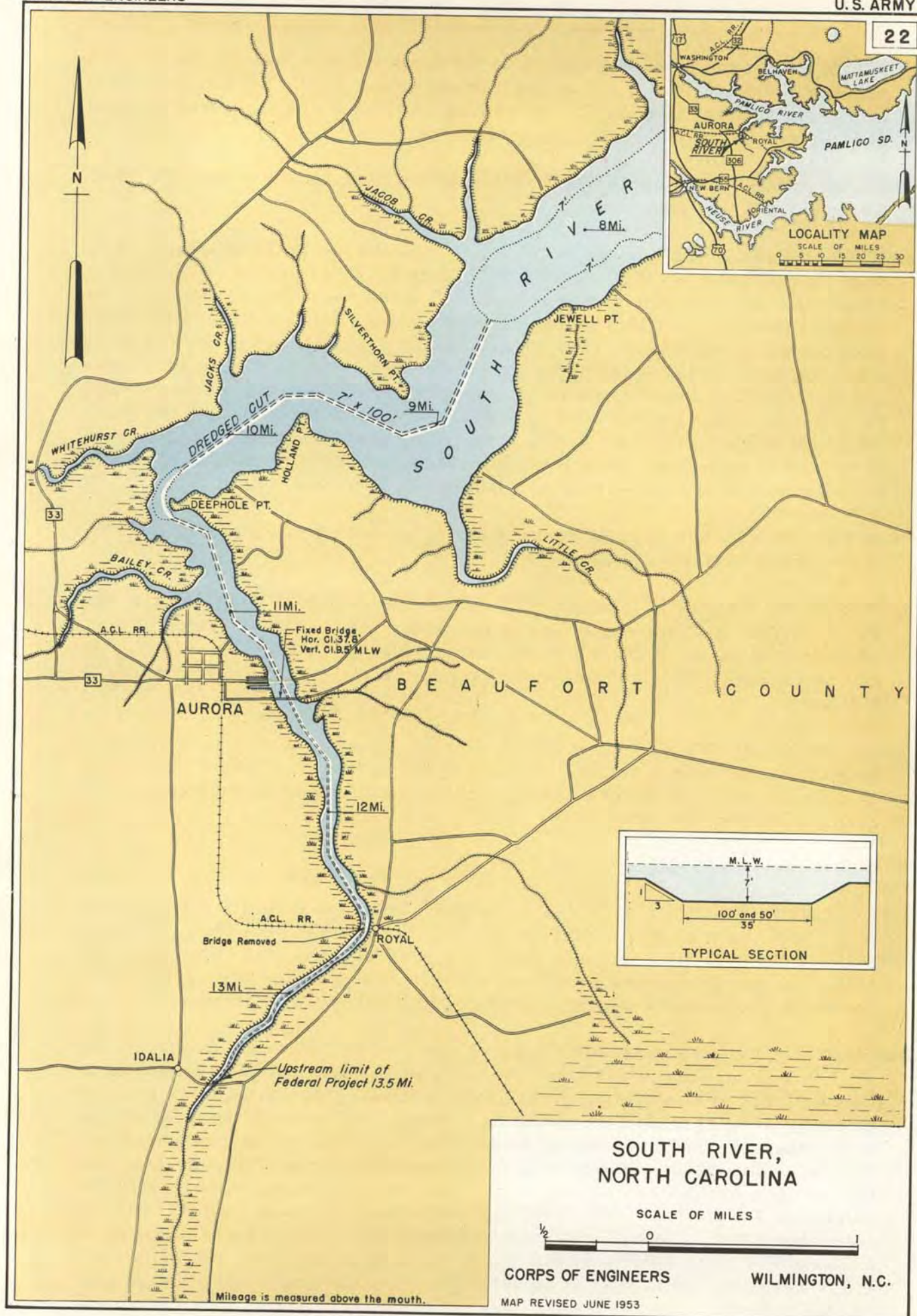
VARIATION OF WATER SURFACE: The stream is nontidal. Variations in the water surface at Washington, due to prevailing winds, seldom exceed 2 feet. The extreme range of the flood or freshet stage for the upper section is 34 feet at Tarboro. For the lower section, the extreme range due to winds is 8.3 feet.

CONTROLLING DEPTH: 11.3 feet to the Atlantic Coast Line Railroad bridge at Washington; 9.7 feet to Hardee Creek; 5.8 feet at mouth of Hardee Creek, and 13.9 feet in basin in Hardee Creek; 3.5 feet to Greenville, and 1 foot to the mouth of Fishing Creek.

COST OF CONSTRUCTION: \$674,651.38

COST OF MAINTENANCE: \$532,485.23 to date. Maintenance costs during recent years have been approximately as follows: 1942 - \$62,000; 1943 - \$10,000; 1946 - \$77,000; 1947 - \$21,000; 1948 - \$4,000. No work has been done since 1948. At that time it was estimated that \$66,000 would be needed for maintenance dredging and snagging, with \$41,000 spent above Washington.

COMMERCE: The five year (1947-51) average was 43,700 tons. In 1941 it was 39,700; in 1952 about 45,000; and 1953 it was 43,000. After the extension to Hardee Creek was completed in 1939 and a terminal constructed there (3 miles below Greenville) traffic increased in this upper reach until the freight boats were taken by the Navy during World War II. Little or no commerce now moves in this reach. The principal commodities during 1951 (the last year for which a breakdown is available) were sugar from Savannah and Philadelphia to Washington - about 5000 tons; petroleum products from Norfolk and Morehead City - about 25,000 tons; soybeans and corn from Washington to Baltimore - about 8000 tons; and some 700 tons of seafood. Estimated ton-miles were 545,706 in 1951 or an average haul within the limits of the project of 13.7 miles.



SOUTH RIVER

LOCATION: A broad-mouthed stream flowing northeast in Beaufort County to the lower reach of the Pamlico River.

EXISTING PROJECT: Authorized by the R & H Acts of June 25, 1910; Mar. 4, 1913 and provides for a channel 7 feet deep and 100 feet wide at mean low water, with necessary widening at channel bends from the head of the 7-foot channel to the town of Aurora; thence 7 feet deep and 50 feet wide at mean low water to Royal; thence 7 feet deep and 35 feet wide at mean low water to Idalia, with increased width on curves; total project length approximately 5 miles.

PROGRESS: Completed in 1913.

VARIATION OF WATER SURFACE: Nontidal. Variations in the water surface due to winds seldom exceed 1 or 2 feet above or below mean stage.

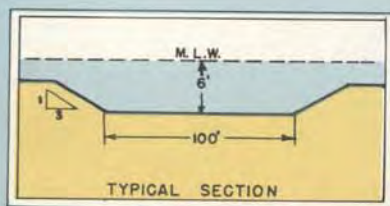
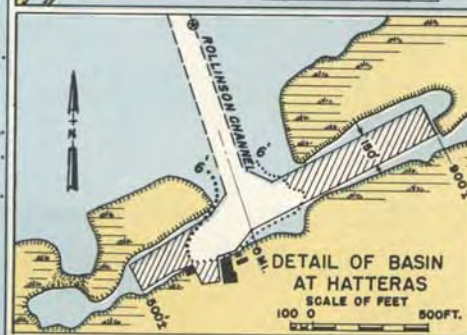
CONTROLLING DEPTH: 7.0 feet available up to a point opposite Main St., Aurora, thence 5.8 feet to Idalia.

COST OF CONSTRUCTION: \$12,452.02

COST OF MAINTENANCE: \$21,623.57. No maintenance dredging has been done since about 1936.

COMMERCE: Average for the 5 year (1947-51) period was 861 tons. About 824 tons moved in 1951, all of which was shellfish. This increased to 1646 tons in 1952 and 975 tons were reported in 1953 (preliminary data).

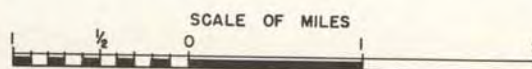
23



Distances are measured seaward from intersection of centerline of Rollinson channel extended and landward limit of improved basin at Hatteras.

Indicates portion not dredged.

ROLLINSON CHANNEL, NORTH CAROLINA



CORPS OF ENGINEERS

WILMINGTON, N. C.

MAP REVISED JUNE 1953

ROLLINSON CHANNEL

LOCATION: This channel extends from deep water in Pamlico Sound to the village of Hatteras, near Hatteras Inlet. A natural inner basin exists at the shore end of the channel.

EXISTING PROJECT: Authorized by the R & H Acts of Aug. 30, 1935; Mar. 2, 1945 and provides for a channel 100 feet wide and 6 feet deep at mean low water from deep water in Pamlico Sound to and including a basin at Hatteras. (A review report was submitted in June, 1952 as to the feasibility of providing breakwaters at the mouth of the harbor and a direct channel to Hatteras Inlet).

VARIATION OF WATER SURFACE: Nontidal. Variations in the water surface due to winds seldom exceed 1 or 2 feet above or below mean stage. Severe windstorms will double or triple this variation.

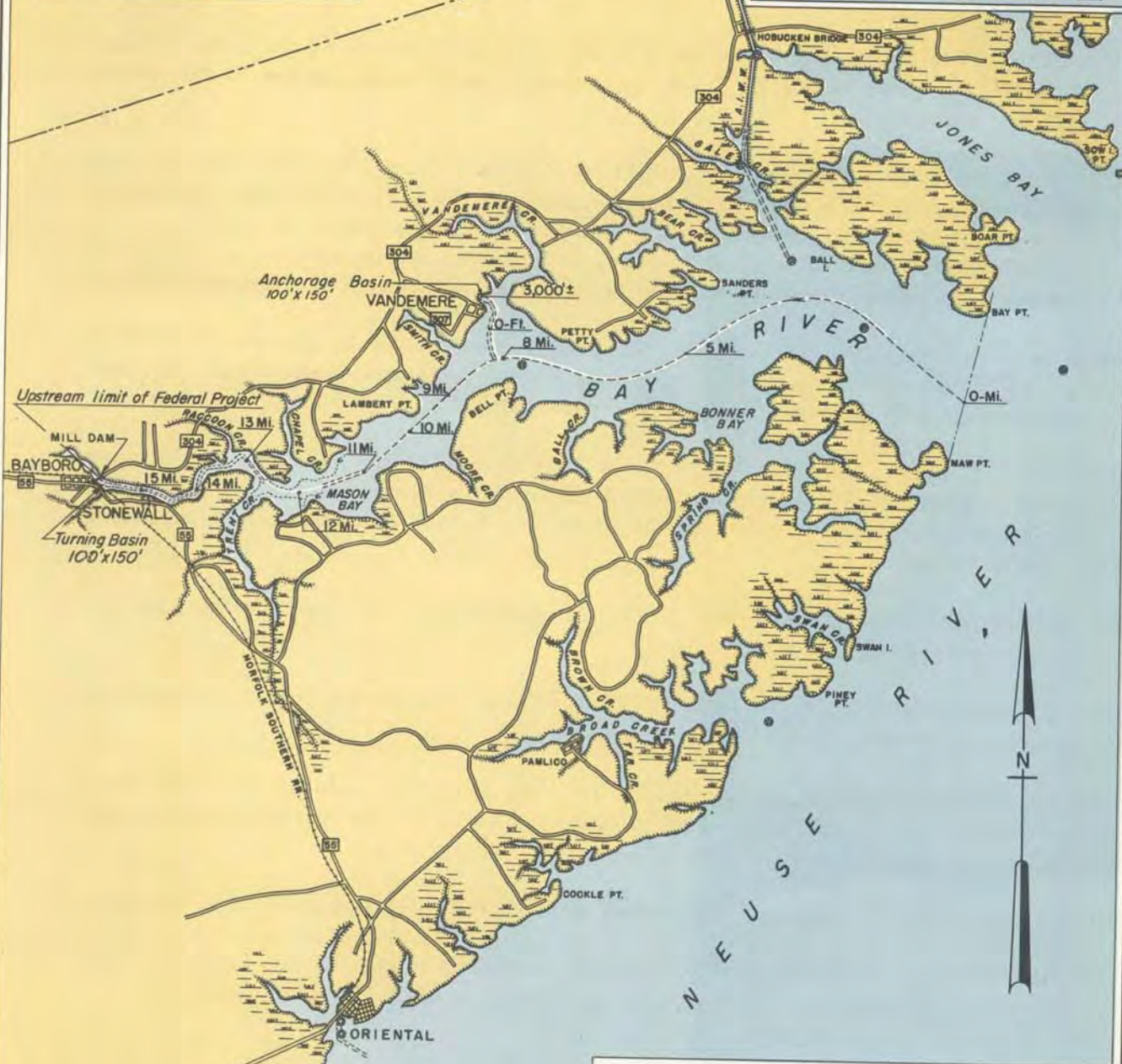
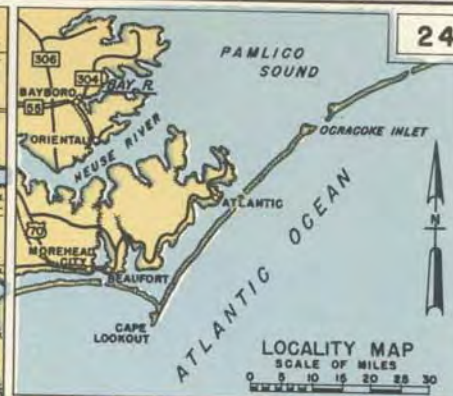
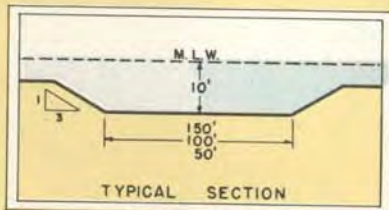
PROGRESS: 27 per cent complete. The 6-foot channel, 100 feet wide, from deep water in Pamlico Sound to the natural inner basin was completed in 1936. No work has been done on the extension of the 6-foot channel to and including basin at Hatteras.

CONTROLLING DEPTH: 6.0 feet in the completed portion, and 6.0 feet to and including existing basin at Hatteras.

COST OF CONSTRUCTION TO DATE: \$20,125.43. Estimated funds necessary to complete project - \$55,000.

COST OF MAINTENANCE: \$122,761.30 to June 30, 1953. Major amounts were expended in the fiscal years 1947, 1948, 1949 and 1952 for maintenance dredging, exceeding \$33,000 in 1952.

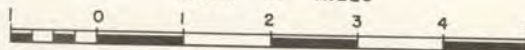
COMMERCE: The average for the 5 year period (1947-51) was 6670 tons annually. In 1951 it was 4280; in 1952 - 3461 tons. The 1953 statistics are incomplete. Although fish, shellfish and petroleum products made up the principal ton-nages, a considerable variety of freight was moved in smaller quantities.



Mileage in Bay River is measured above the mouth. Distance in the side channel to Vandemere is measured from the intersection of that channel and deep water in Bay River.

BAY RIVER, NORTH CAROLINA

SCALE OF MILES



CORPS OF ENGINEERS

WILMINGTON, N. C.

MAP REVISED JUNE 1953

BAY RIVER

LOCATION: Bay River is a 20 mile-long stream which enters Pamlico Sound just north of the Neuse River mouth. Bayboro 17 miles above the mouth is the practical head of navigation.

EXISTING PROJECT: Authorized by the R & H Acts of June 25, 1910; Aug. 26, 1937 and provides for a channel in Bay River 10 feet deep at mean low water and 150 feet wide from the natural deep water to a point 3500 feet below Stonewall; 10 feet deep and 100 feet wide from that point to Bayboro; 10 feet deep at mean low water and 50 feet wide up the Northwest Prong to the Mill Dam, ending in a turning basin 100 feet by 150 feet; also for a channel 10 feet deep and 100 feet wide from deep water in Bay River to and along the wharves of Vandemere, ending in an anchorage basin of the same depth and 150 feet wide on the north side of town.

PROGRESS: Completed in 1939.

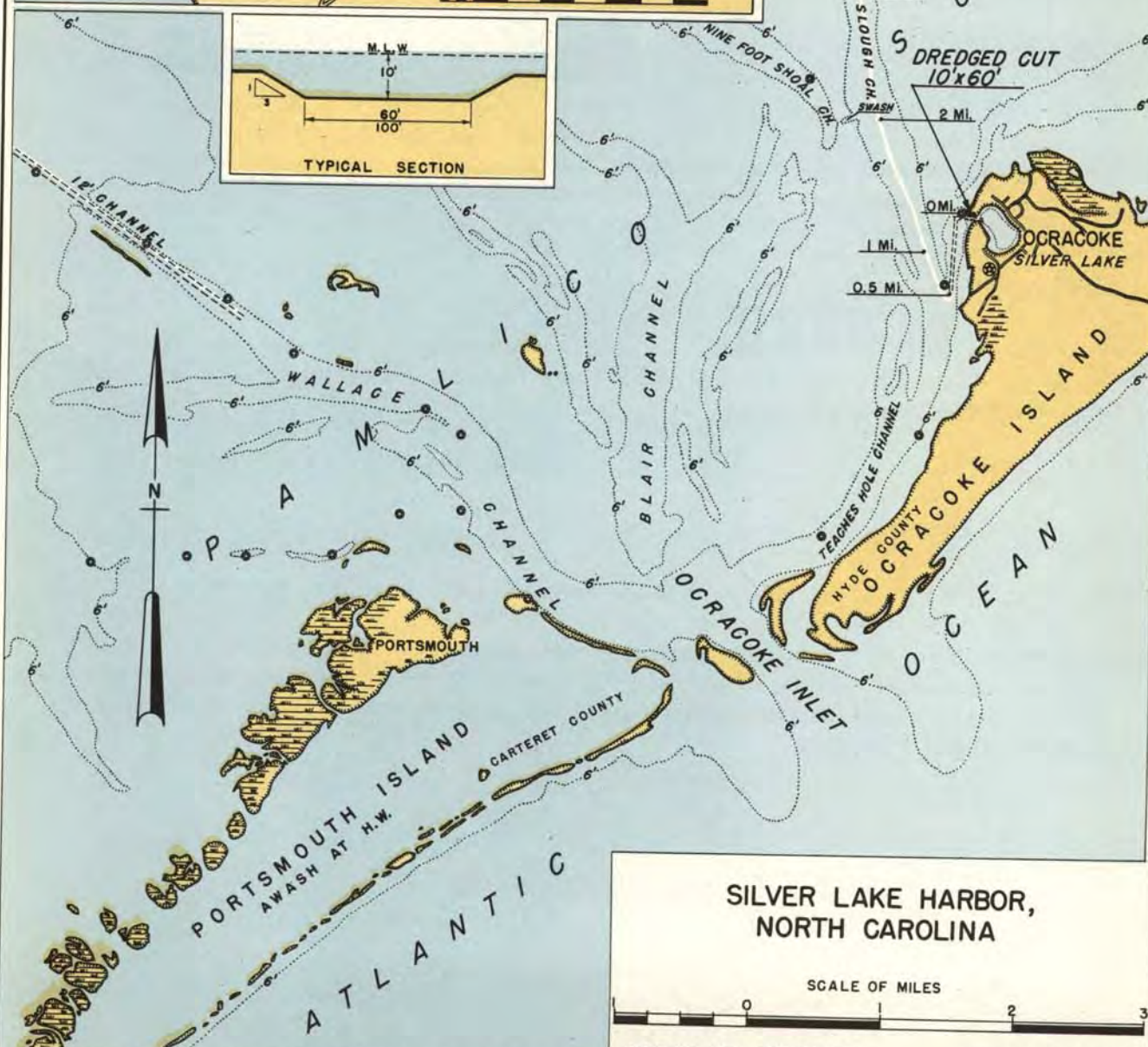
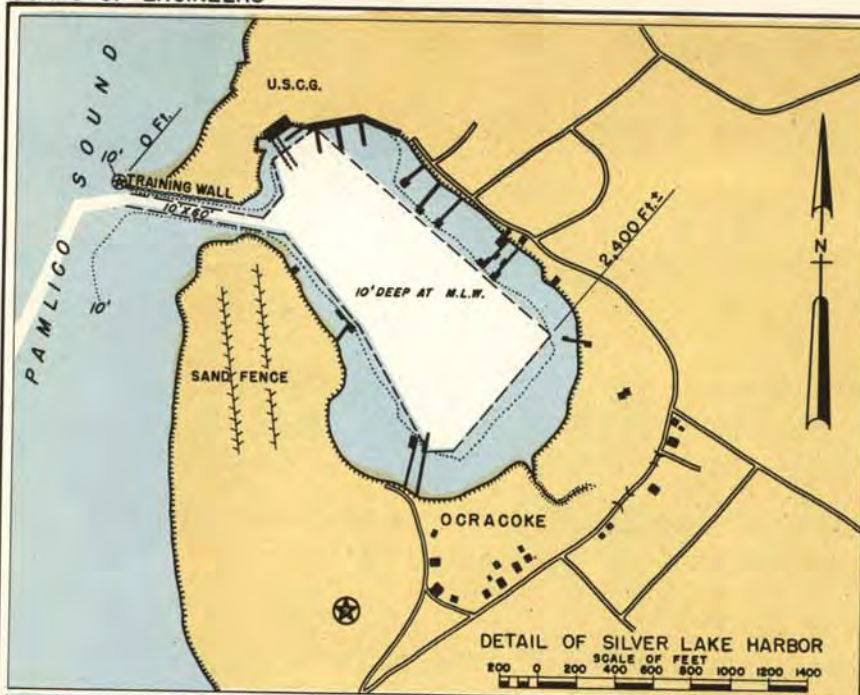
VARIATION OF WATER SURFACE: Nontidal. Variations of water surface, due to winds, normally does not exceed 1 foot, but may be as much as 5 feet during severe easterly storms.

CONTROLLING DEPTH: 10.0 feet to Bayboro, and 9.5 feet to Vandemere.

COST OF CONSTRUCTION: \$44,381.56

COST OF MAINTENANCE: \$49,626.82. No work has been done since 1941.

COMMERCE: For the 5 year period (1947-51) commerce averaged 4400 tons annually. About 3700 tons moved in 1951 nearly all of which were marine products - fish, shellfish and oyster shells. In 1952 commerce totaled 3645 tons and in 1953 it was 3301.



SILVER LAKE HARBOR, NORTH CAROLINA

SCALE OF MILES

CORPS OF ENGINEERS

WILMINGTON, N.C.

MAP REVISED JUNE 1953

Distances are measured from the westernmost land point North of the entrance to Silver Lake Harbor.

SILVER LAKE HARBOR

LOCATION: Silver Lake is at the westerly end of Ocracoke Island forming the harbor, or boat basin of Ocracoke village, about 4 miles north of the inlet.

EXISTING PROJECT: Authorized by the R & H Acts of July 3, 1930; Oct. 17, 1940 and provides for a channel 10 feet deep from that depth in Pamlico Sound to and including an anchorage basin of the same depth in Silver Lake Harbor, with a width of 100 feet across Big Foot Slough bar, and 60 feet in the entrance channel, together with a training wall 300 feet long to protect the outer end of the entrance channel from northeast storms.

PROGRESS: Completed in 1942.

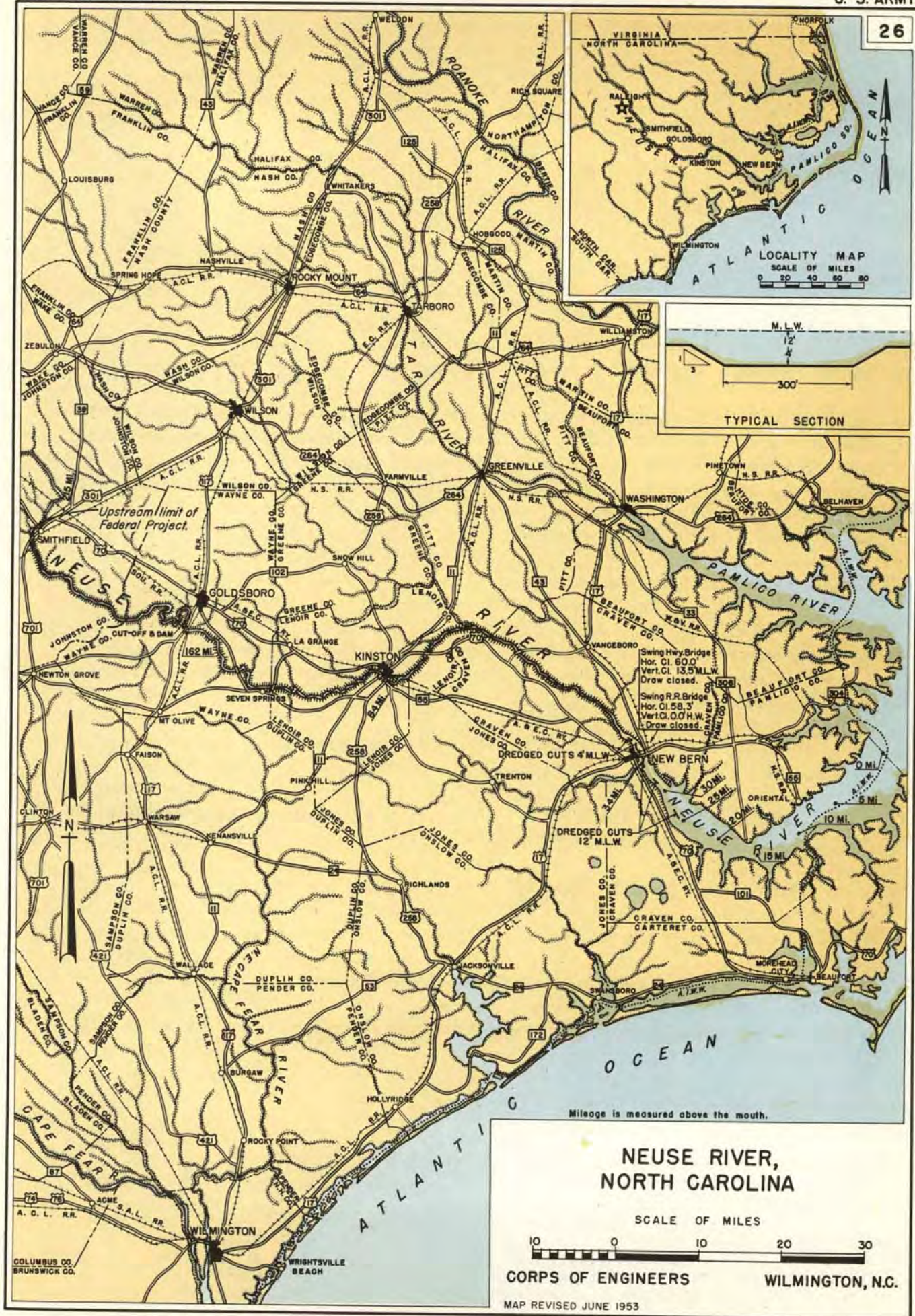
VARIATION OF WATER SURFACE: The ordinary range of tides is about 1 foot within the lake and about 2 1/2 feet at the outer end of the connecting channel. Severe storm tides have been known to raise the water surface of the lake as much as 5 feet.

CONTROLLING DEPTH: 3.6 feet in Big Foot Slough bar channel and 10.0 feet in the entrance channel and basin at Ocracoke.

COST OF CONSTRUCTION: \$67,241.30. The originally authorized (1930) project providing 5-foot depth was completed in 1931 at a cost of \$11,000.

COST OF MAINTENANCE: \$47,884.98. The last work, except condition surveys, was done in 1948 costing about \$6000. In 1948 it was estimated that \$25,000 would be required to restore project depths.

COMMERCE: For the 5 year period (1947-51) commerce averaged about 3700 tons annually. In 1952 and 1953 approximately the same amounts moved, mostly seafood and petroleum products but with small tonnages of miscellaneous freight.



NEUSE RIVER

LOCATION: The Neuse River rises in the north-central part of the State and flows generally southeast some 300 miles to Pamlico Sound.

EXISTING PROJECT: Authorized by the R & H Acts of June 18, 1878; June 13, 1902; Jan. 21, 1927 and provides for a channel 300 feet wide and 12 feet deep at mean low water from a point 10 miles below, up to and in front of New Bern; 4 feet deep at dead low water to Kinston, and during 9 months of the year 3 feet deep at dead low water to Smithfield, to be obtained by dredging and snagging.

VARIATION OF WATER SURFACE: Nontidal. Variations in the water surface at and below New Bern, due to prevailing winds, seldom exceed 2 feet above or below mean stage; however, a 4 year tide-gage record at New Bern shows a maximum range for wind tides of 8.3 feet.

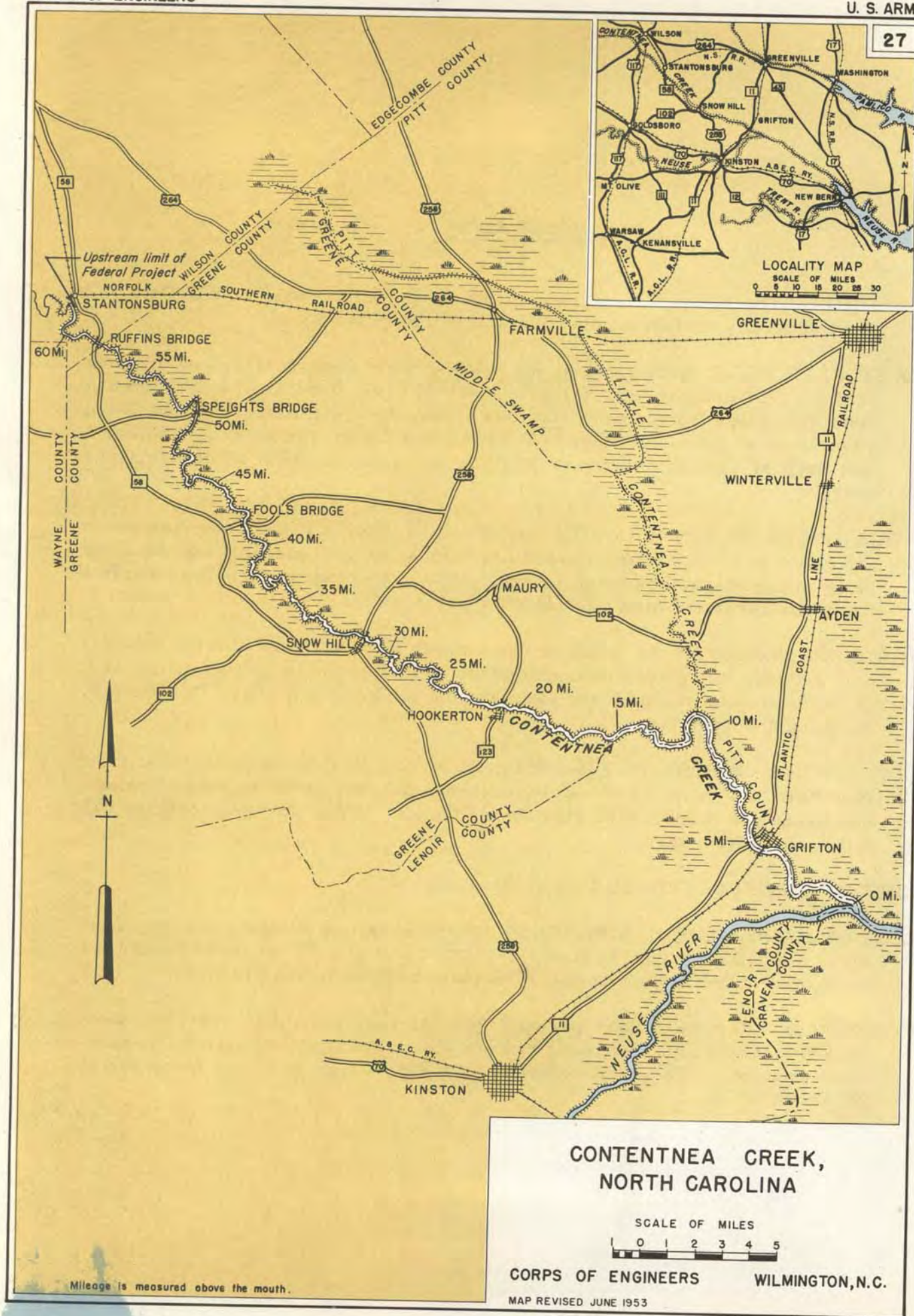
PROGRESS: Except for the width of the channel in front of New Bern, which is only 200 feet, the project was completed in 1929 to the practicable limit as it is impracticable to obtain and maintain the project depth above New Bern by snagging and dredging.

CONTROLLING DEPTH: 10.7 feet from the mouth to New Bern; 3.8 feet from New Bern to a point 23 miles above; thence 2.7 feet to the mouth of Contentnea Creek, 32 miles above New Bern; thence 1.0 foot to Seven Springs, 75 miles above New Bern.

COST OF CONSTRUCTION TO DATE: \$403,066.04

COST OF MAINTENANCE: \$288,959.59. No maintenance dredging has been done since April, 1941. In 1949 it was estimated that \$15,000 would be needed for dredging in front of New Bern. 1954 cost would be materially higher.

COMMERCE: For the 5 year period (1947-51) commerce has averaged about 20,000 tons with logs, fertilizer and petroleum products comprising the principal tonnages. The 1952 commerce totaled 16,125 tons and increased to 25,529 in 1953.



CONTENTNEA CREEK

LOCATION: Contentnea Creek, the largest tributary of the Neuse River, with a drainage area of about 1000 square miles, joins the Neuse from the northwest about 18 miles below Kinston.

EXISTING PROJECT: Authorized by the R & H Act of Mar. 3, 1881 and provides for maintenance of the stream between its mouth and Stantonsburg by removing obstructions from the natural channel so as to obtain a depth of not less than 3 feet during 9 months of the year. Snow Hill, 32 miles from the mouth, is practically the head of navigation. The present condition of the stream is poor. Abandonment of the portion above Snow Hill was recommended in 1926 (House Doc., 467, 69th Cong., 1st Sess.).

PROGRESS: Completed in 1896.

VARIATION OF WATER SURFACE: Nontidal.

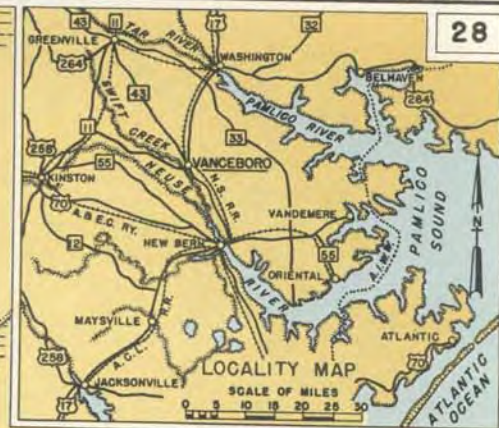
CONTROLLING DEPTH: Portion under improvement snagged and cleared of obstructions in 1940. Present condition fair. Navigable during freshet stages only.

COST OF CONSTRUCTION: \$64,394.56

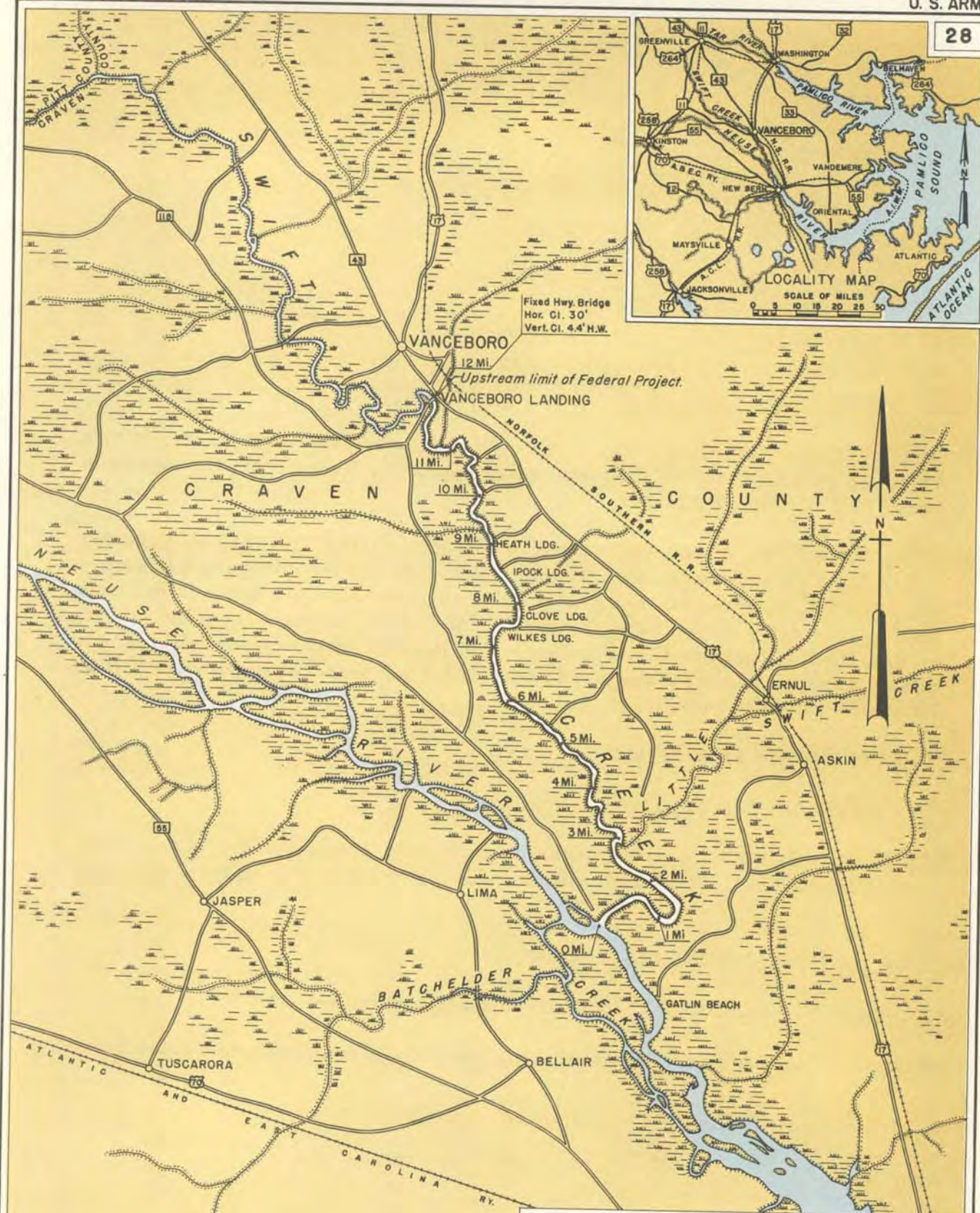
COST OF MAINTENANCE: \$32,247.15; no work done since 1940.

COMMERCE: No commerce has been reported on Contentnea Creek since 1935.

28

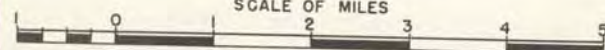


Fixed Hwy. Bridge
Hor. Cl. 30'
Vert. Cl. 4.4' H.W.



SWIFT CREEK, NORTH CAROLINA

SCALE OF MILES



CORPS OF ENGINEERS

WILMINGTON, N.C.

MAP REVISED JUNE 1953

Mileage is measured above the mouth.

SWIFT CREEK

LOCATION: Swift Creek has its source in the swamps of Pitt County, about 5 miles south of Greenville. It flows southeasterly 43 miles and empties into the Neuse River 7.5 miles above New Bern.

EXISTING PROJECT: Authorized by the R & H Act of June 25, 1910 and provides for clearing the channel from the mouth to Vanceboro, 12 miles, of snags and overhanging and leaning trees.

PROGRESS: Completed in 1910.

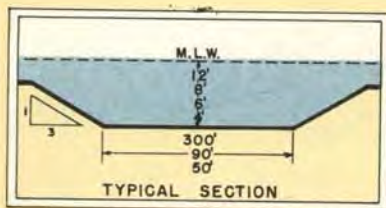
VARIATION OF WATER SURFACE: The rise of water level, due to prevailing winds and floods, reaches its maximum height of about 12 feet at Vanceboro.

CONTROLLING DEPTH: The stream is in poor condition.

COST OF CONSTRUCTION: \$1,600.00

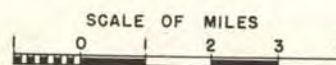
COST OF MAINTENANCE: \$5,422.00. No work has been done in many years.

COMMERCE: After logging operations (rafting) practically ceased in the late 1930's no commerce has been reported except 610 tons of rafted logs in 1942.



Mileage is measured above the mouth.

TRENT RIVER,
NORTH CAROLINA



CORPS OF ENGINEERS

WILMINGTON, N.C.

MAP REVISED JUNE 1953

TRENT RIVER

LOCATION: This stream sources in Jones County and flows 80 miles in a meandering course to its junction with the Neuse River at New Bern.

PREVIOUS PROJECTS: Authorized by R & H Acts of 1879, '85, '87, '89 and '96.

EXISTING PROJECT: Authorized by the R & H Acts of June 13, 1902; June 25, 1910; Jan. 27, 1927; Mar. 2, 1945 and provides for a channel 12 feet deep at mean low water and 300 feet wide in front of New Bern; a channel 6 feet deep at dead low water over Foys Flats; a channel 50 feet wide and 4 feet deep at low water to Trenton; and a boat basin at New Bern 600 feet long and 250 feet wide and a repair basin 300 feet long and 220 feet wide at the adjacent boat works, with an access channel 90 feet wide to each basin, all to a depth of 8 feet at mean low water. The length of section included in the project is 38 miles.

VARIATION OF WATER SURFACE: Near the mouth the water level varies about 2 feet under normal conditions, according to prevailing winds.

PROGRESS: The existing project is 80 per cent complete. That part of the project providing for a depth of 12 feet and width of 300 feet in front of New Bern, a channel 6 feet deep at dead low water over Foys Flats, and a channel 50 feet wide and 4 feet deep to Trenton, 38 miles above the mouth, was completed in 1929. No work has been done on the boat basins and access channels at New Bern.

CONTROLLING DEPTH: 11.8 feet at New Bern, 6.0 feet from New Bern to Pollocksville, 18 miles above New Bern, 3.5 feet thence to Trenton, 38 miles above New Bern.

COST OF CONSTRUCTION TO DATE: \$115,199.45 including \$70,905.40 spent on previous projects. It was estimated in 1953 that \$24,600 would be required to complete this project. The Corps of Engineers has recently completed a study as to the advisability of changing the location of the boat basins as authorized in 1945. The report is unfavorable to a change.

COST OF MAINTENANCE: \$69,787.77. No maintenance work has been done since 1942 when about \$6000 was expended for this purpose.

COMMERCE: For the 5 year period (1947-1951) commerce averaged about 10,000 tons annually. In 1951 some 11,500 tons moved, of which all but about 300 tons (seafood) was logs (8000 tons) and petroleum products (3200 tons). About 8593 tons moved in 1952 and 7168 in 1953.



SMITHS CREEK (PAMLICO CO., N. C.)

LOCATION: Smiths Creek rises in Pamlico County, flows generally southerly, and empties into the Neuse River at the town of Oriental, 25 miles downstream from New Bern.

EXISTING PROJECT: Authorized by the R & H Act of June 25, 1910 and provides for the excavation of a basin in the small bay located in the center of the town of Oriental, and just inside the mouth of the creek, to a mean low water depth of 10 feet, and the removal of several lumps and projecting points in the entrance channel. (A study and report was submitted by the Chief of Engineers in 1952 recommending a change in the existing project to provide a rubble-mound breakwater to protect the harbor of Oriental at an estimated cost of \$97,900 - see House Doc. 170, 83d Cong., 1st Sess.).

PROGRESS: Completed in 1936.

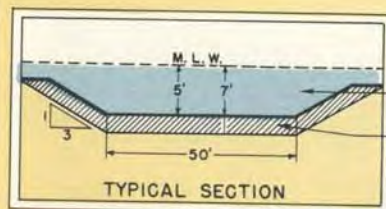
VARIATION OF WATER SURFACE: Nontidal. Variations in the water surface due to winds seldom exceed 2 feet above or below mean stage. Extreme range of wind tides in 8.3 feet.

CONTROLLING DEPTH: 10.0 feet in basin; 10.0 feet in entrance channel.

COST OF CONSTRUCTION: \$14,471.80

COST OF MAINTENANCE: \$23,780.07. The last maintenance work was done in 1948 when about 50,000 cubic yards of material was dredged from the channel at a cost of approximately \$17,000.

COMMERCE: For the 5 year period (1947-51) commerce averaged 1,557 tons annually practically all of which was fish and shellfish. About 1700 tons moved in 1952 and 2369 in 1953.

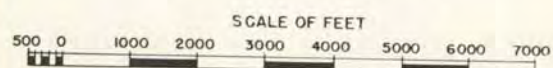


5' channel 50' wide completed in 1921.

No work has been done on increasing the depth to 7', same width.

Mileages are measured eastward and westward from the highway bridge.

CHANNEL CONNECTING THOROUGHFARE BAY WITH CEDAR BAY, NORTH CAROLINA



CORPS OF ENGINEERS
MAP REVISED JUNE 1953

WILMINGTON, N.C.

CHANNEL CONNECTING THOROUGHFARE BAY WITH CEDAR BAY

LOCATION: Thoroughfare Bay is on the north side of Core Sound, about 6 miles west of the end of the peninsula at the junction of Core and Pamlico Sounds.

EXISTING PROJECT: Authorized by the R & H Acts of Mar. 2, 1919; Mar. 2, 1945 and provides for a channel 7 feet deep and 50 feet wide, with increased width at bends, to connect Thoroughfare Bay and Cedar Bay. The channel is about 4 miles long.

VARIATION OF WATER SURFACE: Nontidal. Variations in the level of the water surface are due to wind action. Ordinary storms will cause a variation of 1 foot above or below the mean stage, while severe storms may cause a variation of as much as 3 feet.

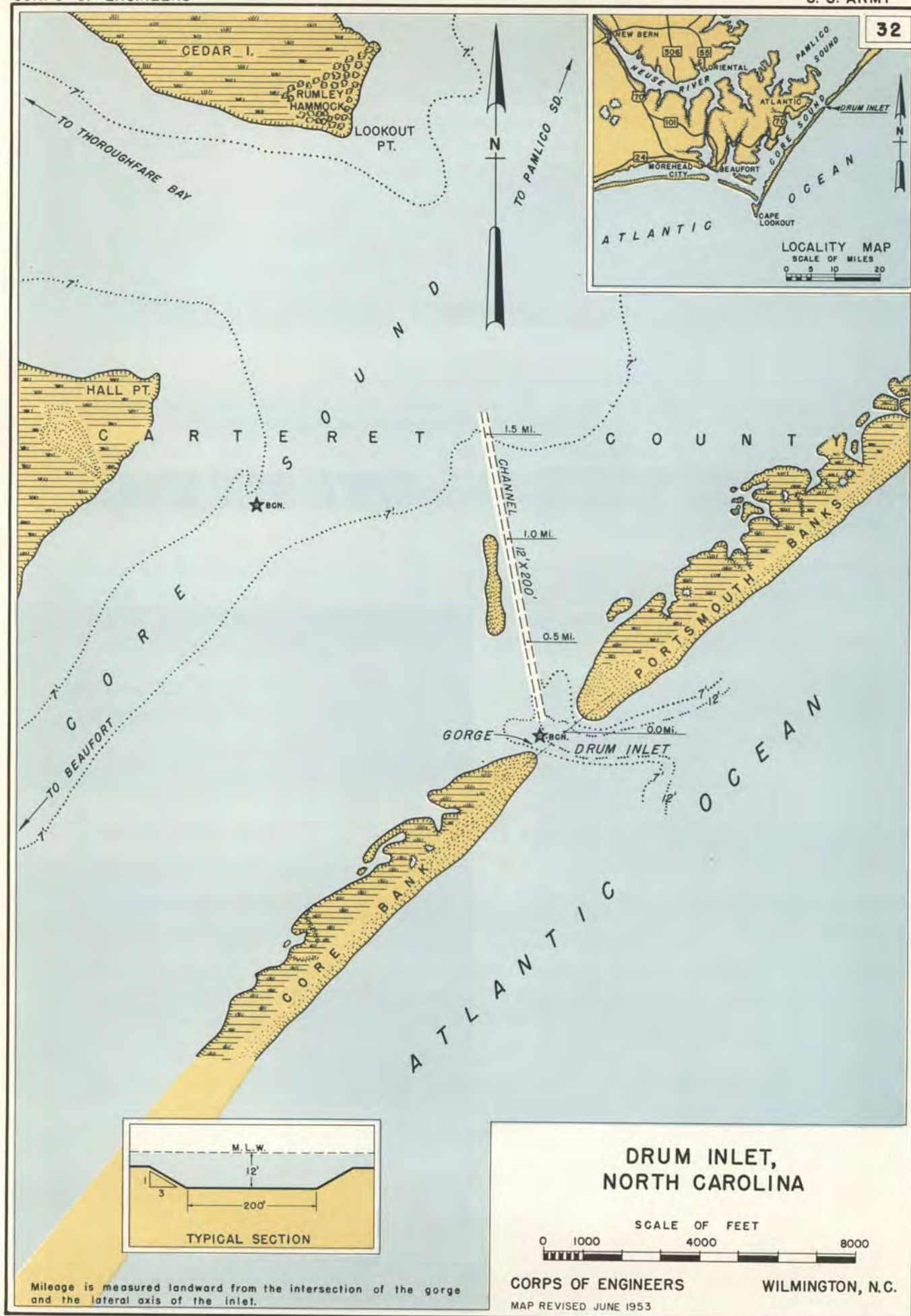
PROGRESS: The existing project is 31 per cent complete. The 5-foot channel, 50 feet wide, was completed in 1921. No work has been done on increasing the depth to 7 feet, same width.

CONTROLLING DEPTH: 3.7 feet.

COST OF CONSTRUCTION TO DATE: \$9,000.00. In 1953 it was estimated that an additional \$30,000 would be required to complete the project.

COST OF MAINTENANCE: \$15,549.10. No maintenance work has been done in recent years.

COMMERCE: For the 5 year period (1947-51) commerce has averaged about 1500 tons annually. In 1951 some 1625 tons moved, consisting entirely of sea-food. In 1952 tonnages amounted to 1717; in 1953 about 1400 tons moved.



DRUM INLET

LOCATION: Drum Inlet is an opening through the barrier beach which separates Core Sound from the Atlantic Ocean. It is about 35 miles northeast of Beaufort and opposite the village of Atlantic.

EXISTING PROJECT: Authorized by the R & H Act of June 20, 1938 and provides for a channel 12 feet deep at mean low water and 200 feet wide from the gorge in the inlet to the federally improved channel in Core Sound, a distance of about 1 mile.

PROGRESS: Completed in 1940..

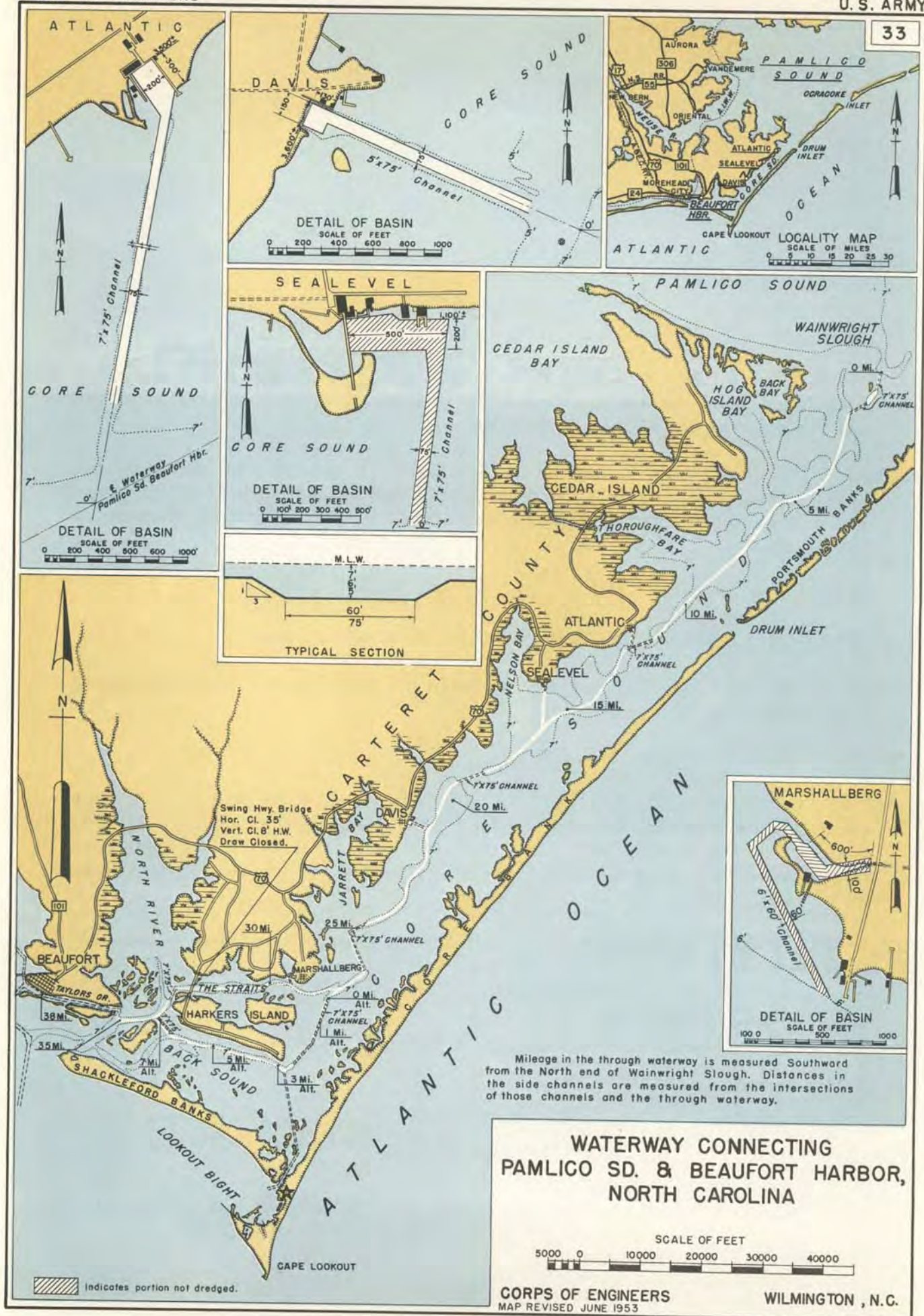
TIDAL RANGE: 3.8 feet in the ocean and 0.3 feet in Core Sound.

CONTROLLING DEPTH: 7.0 feet on the ocean bar and 7.4 feet in the channel in Core Sound.

COST OF CONSTRUCTION: \$52,828.22

COST OF MAINTENANCE: \$153,813.31. The last work done was in 1952 when about 100,000 cubic yards were dredged from shoals in the channel portion at a cost of about \$36,000. Also, in fiscal 1950 nearly \$31,000 was expended on maintenance. The latest (1953) approved estimate for annual cost of maintenance is \$25,000.

COMMERCE: After reaching a high of over 4000 tons in 1944 commerce decreased to an annual average of only 200 tons in the 5 year period (1947-51), consisting entirely of fish and shellfish. Commerce in 1952 and 1953 was 222 and 246 tons, respectively.



WATERWAY CONNECTING PAMLICO SD. & BEAUFORT HARBOR

LOCATION: This waterway begins at the southeast corner of Pamlico Sound, passing southwesterly through Wainwright Slough, Core Sound, and The Straits, to Beaufort Harbor, a total length of 33.9 miles.

PREVIOUS PROJECT: The R & H Acts of 1913 and 1922 authorized a limited amount of work (2 3/4 miles) on this waterway, at a cost of about \$20,000 in addition to \$10,000 contributed by local interests.

EXISTING PROJECT: Authorized by the R & H Acts of Aug. 30, 1935, Aug. 26, 1937; Mar. 2, 1945; May 17, 1950 and provides for a channel 7 feet deep at mean low water and 75 feet wide from Pamlico Sound to Beaufort Harbor by way of Wainwright Slough, Core Sound and The Straits; also for an alternate route of the same width and depth, through Back Sound by way of channels at east and west ends of Harkers Island; for a channel 7 feet deep and 75 feet wide from the main channel in Core Sound to the town of Atlantic; for a side channel 5 feet deep, 75 feet wide, with a basin 150 feet by 130 feet, same depth, at Davis; for a side channel 7 feet deep, 75 feet wide, with a basin 200 feet by 500 feet, same depth, at Sealevel; and for a side channel 6 feet deep; 60 feet wide, from the 6-foot contour in The Straits, to, and including a basin 100 feet by 600 feet, same depth, at Marshallberg. (In 1948 the Chief of Engineers approved transfer of the Taylors Creek reach of this project to the project for Beaufort Harbor).

PROGRESS: The existing project is 57 per cent complete. That portion of the project providing for a through channel from Pamlico Sound to Beaufort Harbor was completed in 1934; the side channel to Atlantic, in 1937; and the side channel and basin at Davis, in 1948. No work has been done on the 7 by 75-foot connecting channels at east and west ends of Harkers Island; the 7 by 75-foot side channel to Sealevel; and the 6 by 60-foot channel and basin at Marshallberg.

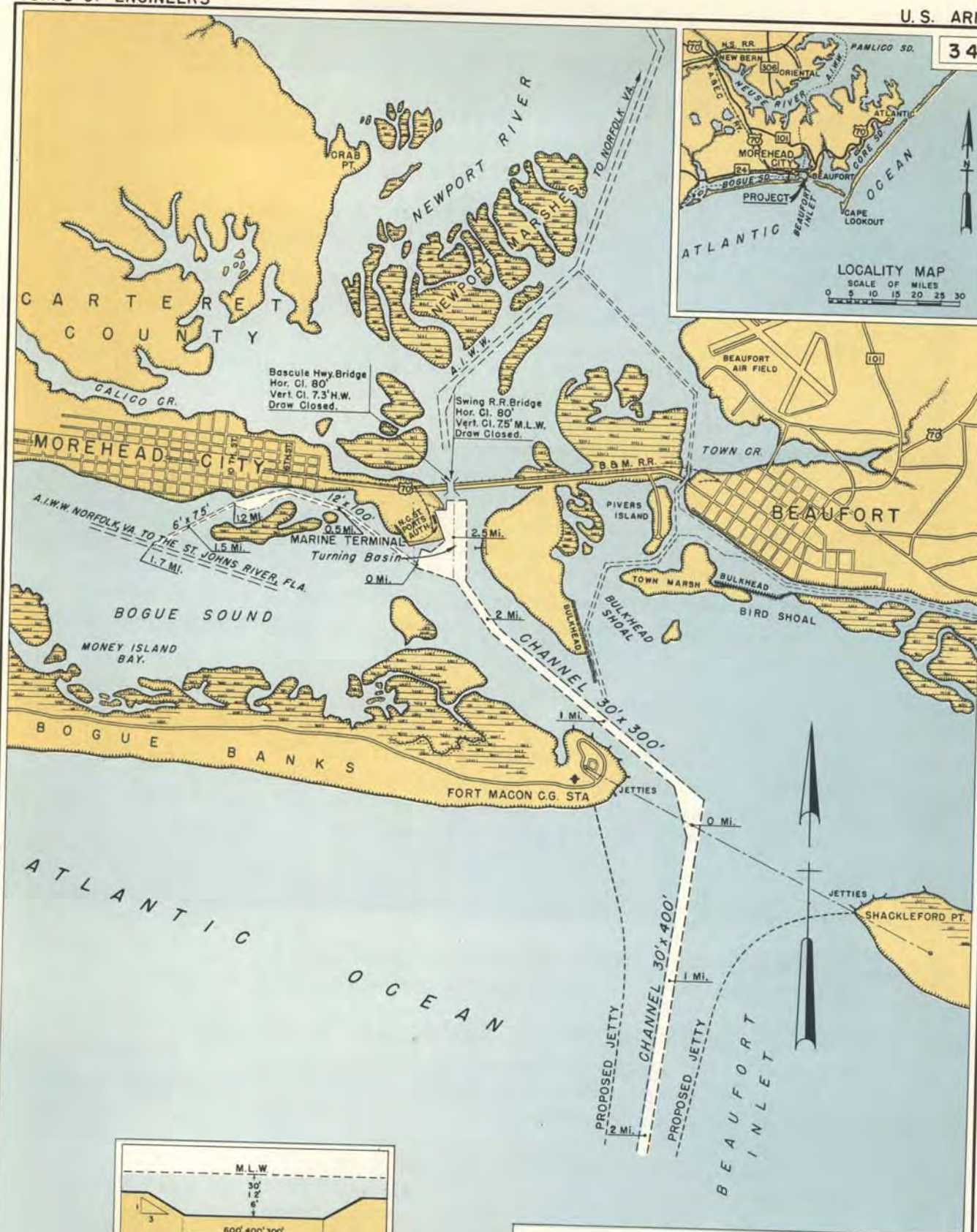
VARIATION OF WATER SURFACE: Variations of 1 foot are caused by wind action.

CONTROLLING DEPTH: 6.0 feet in the through waterway; 7.0 feet in the side channel to Atlantic, N. C.; and 5.0 feet in the side channel to Davis, N. C.

COST OF CONSTRUCTION TO DATE: \$92,842.89 which includes expenditures on previous projects and Works Progress Administration funds of \$18,584.53 (of which \$5,412.81 was contributed by local interests). In 1953 it was estimated that \$130,600 would be needed to complete the project.

COST OF MAINTENANCE: \$158,561.12 in addition to about \$35,000 expended for maintenance on the previous project. The last major work done was during 1952 when about \$31,000 was expended on maintenance dredging of about 17,000 cubic yards of shoaling in the basin at Davis and in the channel leading to Atlantic.

COMMERCE: In the last 4 years commerce, almost entirely marine products, has been as follows: 1950 - 12,137 tons; 1951 - 9790 tons; 1952 - 12,596 tons; 1953 - 9237 tons. Before 1950 commerce over Taylors Creek, now a part of the Beaufort Harbor project, was included in the totals.



MOREHEAD CITY HARBOR,
NORTH CAROLINA

Mileage in the 12 & 6 foot channels is measured westward from the intersection of the 12 foot channel and the 30 foot channel.

CORPS OF ENGINEERS

WILMINGTON, N. C.

MAP REVISED JUNE 1953

MOREHEAD CITY HARBOR

LOCATION: On the northern shore of Bogue Sound, adjacent to Beaufort Harbor and Inlet.

PREVIOUS PROJECT: Adopted by the R & H Act of March 3, 1905 under the title of "Beaufort Inlet." About \$45,000 was spent for new work and \$285,000 for maintenance under the previous authorization.

EXISTING PROJECT: Authorized by the R & H Acts of June 25, 1910; July 3, 1930; Aug. 26, 1937 and provides for a channel 30 feet deep and 400 feet wide across the ocean bar at Beaufort Inlet, thence same depth and 300 feet wide to the marine terminals at Morehead City, enlarged to 600 feet to form a turning basin at that point, and for construction of jetties at the inlet; for a channel 12 feet deep and 100 feet wide from the 30-foot channel to Sixth Street, Morehead City, thence same depth and 200 to 400 feet wide to Tenth Street, thence 6 feet deep and 75 feet wide to deep water in Bogue Sound. (A study has been completed recently to determine the feasibility of enlarging the turning basin and providing increased depths in the 30-foot channel).

VARIATION OF WATER SURFACE: 2.5 feet at Morehead City and 3.5 feet at the inlet.

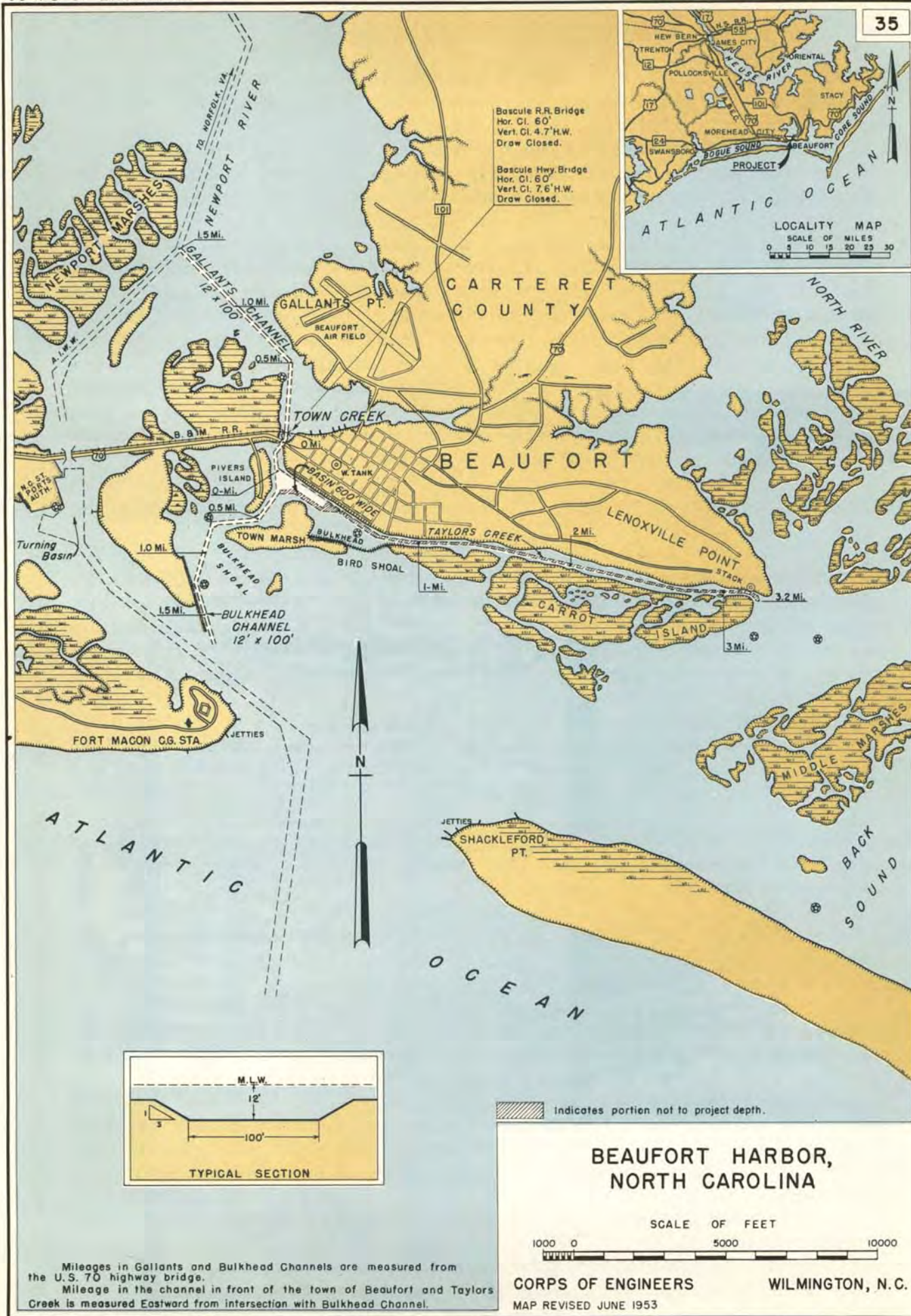
PROGRESS: The existing project is 40 per cent complete. The part of the existing project providing for a 12-foot channel to Morehead City, thence a 6-foot channel westward to Bogue Sound was completed in 1931; the part providing for the 30-foot channel to the terminals was completed in 1936. Construction of the jetties proposed for Beaufort Inlet has been indefinitely deferred.

CONTROLLING DEPTH: 30.0 feet in the ocean bar channel; 27.9 feet in the 30-foot channel (inside) to the terminals at Morehead City; 10.9 feet from deep water in the outer harbor to the foot of Tenth Street, Morehead City, and thence 4.0 feet westward to Bogue Sound.

COST OF CONSTRUCTION TO DATE: \$657,590.64, including cost of previous projects. Estimated (1953) additional cost to complete presently authorized project - \$2,875,000.

COST OF MAINTENANCE: \$2,082,283.11, including expenditures on the previous projects. Maintenance dredging has been required every year for the past 5 years and has averaged about \$160,000 annually.

COMMERCE: Morehead City is a deep-water port and with the recently added facilities provided at the State Port Authority terminal commerce has increased in the past few years. For the 5 year period (1947-51) commerce averaged about 260,000 tons annually. In 1951 about 344,000 tons were moved of which 130,420 tons were foreign imports and 167,829 tons were coast-wise receipts; both movements being almost entirely petroleum products. In 1952 a total of 455,742 tons passed through the port. This increased again to a total tonnage of 564,413 in 1953. In addition to the above commerce published (1951) and advance (1952 and 1953) data shows "through traffic" items of approximately 32,000; 51,000 and 43,000 tons respectively. These movements were comprised almost entirely of menhaden coming into the fish processing plants at and in the vicinity of Morehead City and Beaufort.



BEAUFORT HARBOR

LOCATION: This harbor is just inside Beaufort Inlet adjacent to Morehead City Harbor.

PREVIOUS PROJECTS: The first project on Beaufort Harbor was adopted by the R & H Act of July 4, 1836. Some \$5000 was expended then for new work and about \$30,000 later, of which \$10,000 were contributed funds.

EXISTING PROJECT: Authorized by the R & H Acts of Mar. 3, 1881; Mar. 2, 1907; June 25, 1910; Mar. 2, 1919; September 22, 1922; Mar. 3, 1925; July 3, 1930; Mar. 2, 1945; May 17, 1950 and provides for the stopping of erosion at Beaufort Inlet by jetties and sand fences at Fort Macon and Shackleford Points and other shore protection; for a channel 12 feet deep at mean low water, 100 feet wide in Bulkhead and Gallants Channels and 600 feet wide in front of the town of Beaufort; for a channel 12 feet deep at mean low water, 100 feet wide and about 2.6 miles long, from a point opposite the foot of Marsh Street in Beaufort, through Taylors Creek to Lenoxville Point at North River; and for the construction of a stone bulkhead from Town Marsh across Bird Shoal to the westerly end of Carrot Island. The distance from the inlet to the upper end of Gallants Channel is about 5 miles.

PROGRESS: The existing project is 66 per cent complete. The deepening of Bulkhead and Gallants Channels and the basin in front of Beaufort was completed in 1931. No work has been done on increasing the width and length of the basin in front of Beaufort and on increasing the width and depth of the channel in Taylors Creek.

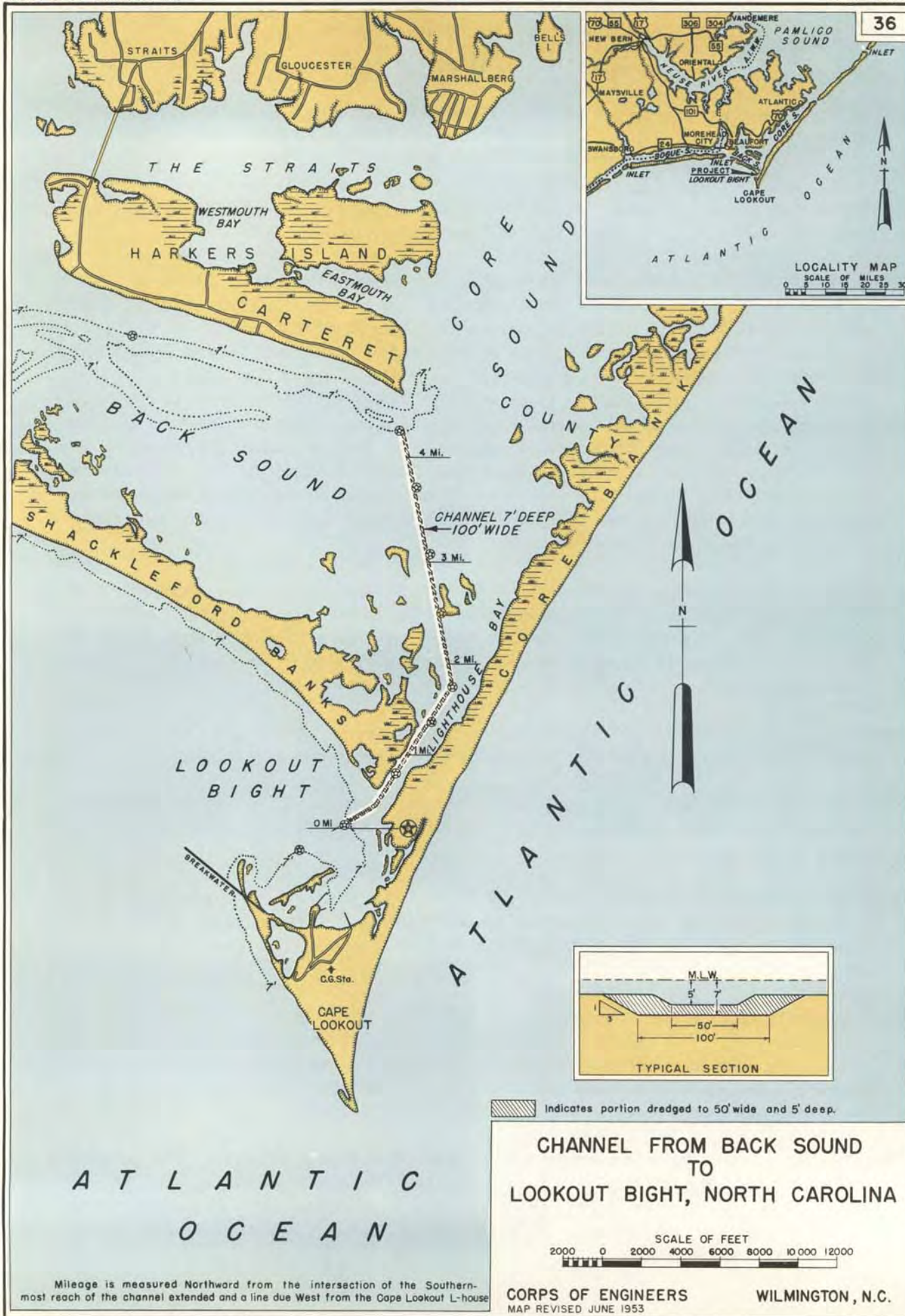
VARIATION OF WATER SURFACE: The average rise of tide is 2.5 feet at Beaufort and 3.5 feet at the inlet. The extreme range of tides is 5 feet.

CONTROLLING DEPTH: 11.9 feet in Bulkhead Channel; 10.4 feet in Gallants Channel; 12.0 feet in the basin in front of Beaufort; and 7.0 feet in Taylors Creek.

COST OF CONSTRUCTION TO DATE: \$297,322.42 plus \$35,000 spent on previous projects. In 1953 it was estimated that \$154,200 would be required to complete the project, of which \$82,200 would be needed for the Taylor Creek work.

COST OF MAINTENANCE: \$440,901.76 including about \$13,000 spent on previous projects. The last maintenance was done in 1953 when 7000 cu. yds. of material was dredged from Gallants Channel at a cost of about \$3400. Maintenance funds were expended for every one of the previous 10 years except in 1944. Annual costs were as high as \$19,000 (1947).

COMMERCE: Including commerce over Taylors Creek, a part of the project since 1950, commerce totaled 38,595 tons in 1950; about 32,000 in 1951; 55,328 in 1952 and 42,234 tons in 1953 (advance data). Commerce is principally fish (menhaden for oil extraction and fertilizer, plus a few hundred tons of edible fresh fish) and shellfish.



CHANNEL FROM BACK SOUND TO LOOKOUT BIGHT

LOCATION: This channel extends from a point near the eastern end of Harkers Island, about 8 miles east of Beaufort, through the shallow waters of Back Sound and Lighthouse Bay, to and through Shackleford Banks, and into the Atlantic Ocean at Lookout Bight. It is about 4 miles long.

EXISTING PROJECT: Authorized by the R & H Acts of Aug. 26, 1937; Mar. 2, 1945 and provides for a channel 100 feet wide and 7 feet deep at mean low water from deep water in Back Sound, through Shackleford Banks to deep water in Lookout Bight.

TIDAL RANGE: The mean range of tide is 3.8 feet in Lookout Bight and 1.3 feet in Back Sound, and the extreme range is 8.3 feet in Lookout Bight and 3.8 feet in Back Sound.

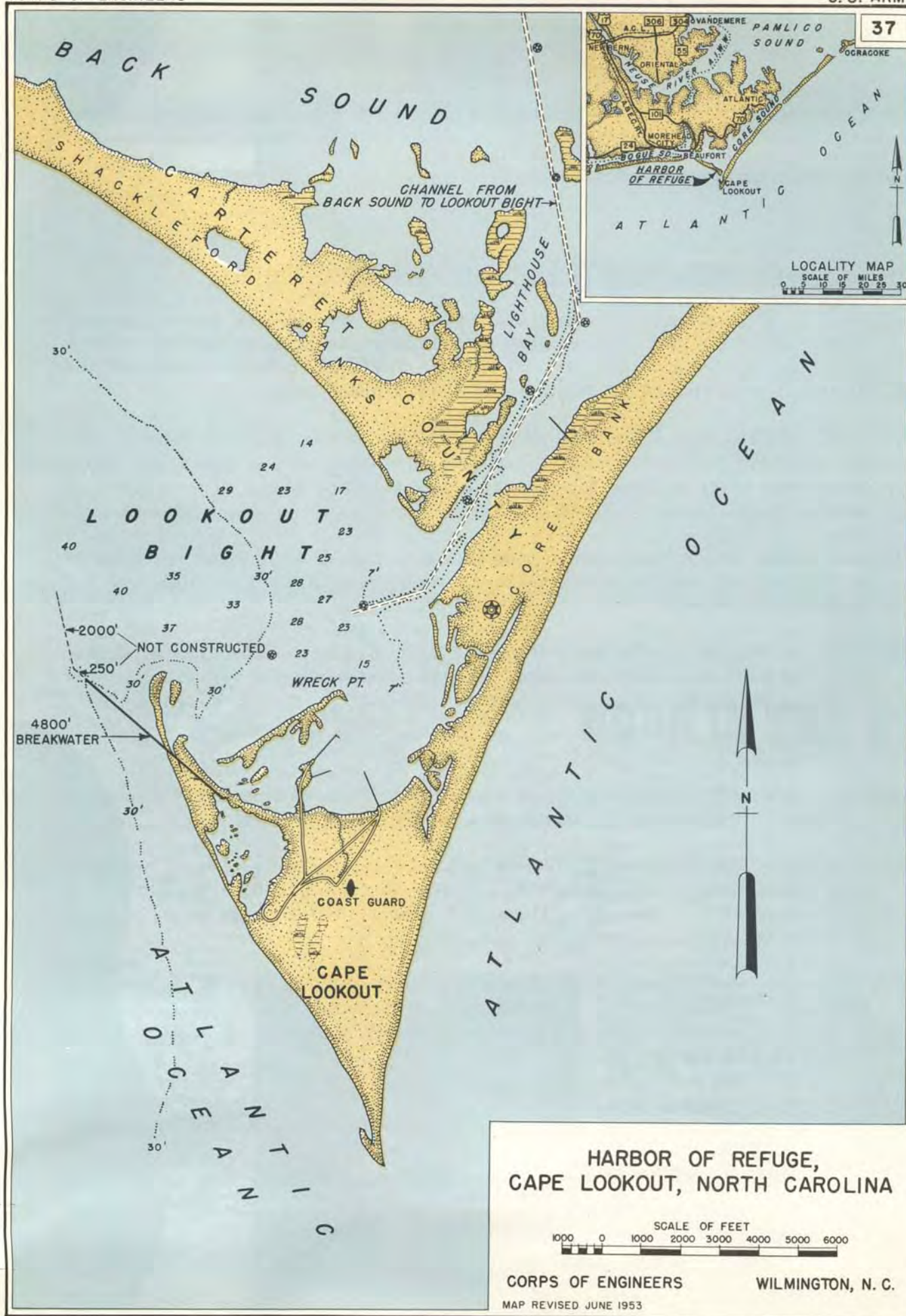
PROGRESS: The existing project is 19 per cent complete. The channel, 5 feet deep, 50 feet wide, was completed in 1938. No work has been done on increasing the depth to 7 feet and width to 100 feet.

CONTROLLING DEPTH: 5.0 feet.

COST OF CONSTRUCTION TO DATE: \$24,676.08. It is estimated (1953) that an additional \$105,000 will be required to complete this project.

COST OF MAINTENANCE: \$176,126.36 to date. Maintenance dredging has been done nearly every year since 1944 at costs of from \$1300 to \$31,000 (fiscal 1949). No work has been done since 1952 when 11,500 yards of material were removed at a cost of \$7729.

COMMERCE: The average annual commerce for the period 1947-51 amounted to 2930 tons, but reached a low of 448 tons in the latter year, almost entirely fresh fish. In 1952 about 3421 tons were moved, dropping again to 2119 tons in 1953 (advance data).



HARBOR OF REFUGE, CAPE LOOKOUT

LOCATION: This is a partially protected natural basin just north and west of Cape Lookout with original depths of from 23 to 40 feet.

EXISTING PROJECT: Authorized by the R & H Act of July 25, 1912 and provides for a harbor of refuge inclosing, by means of a rubble-stone breakwater 7050 feet long, an area of 575 acres of 30 feet or more in depth at mean low water. The breakwater is visible only on extreme low water.

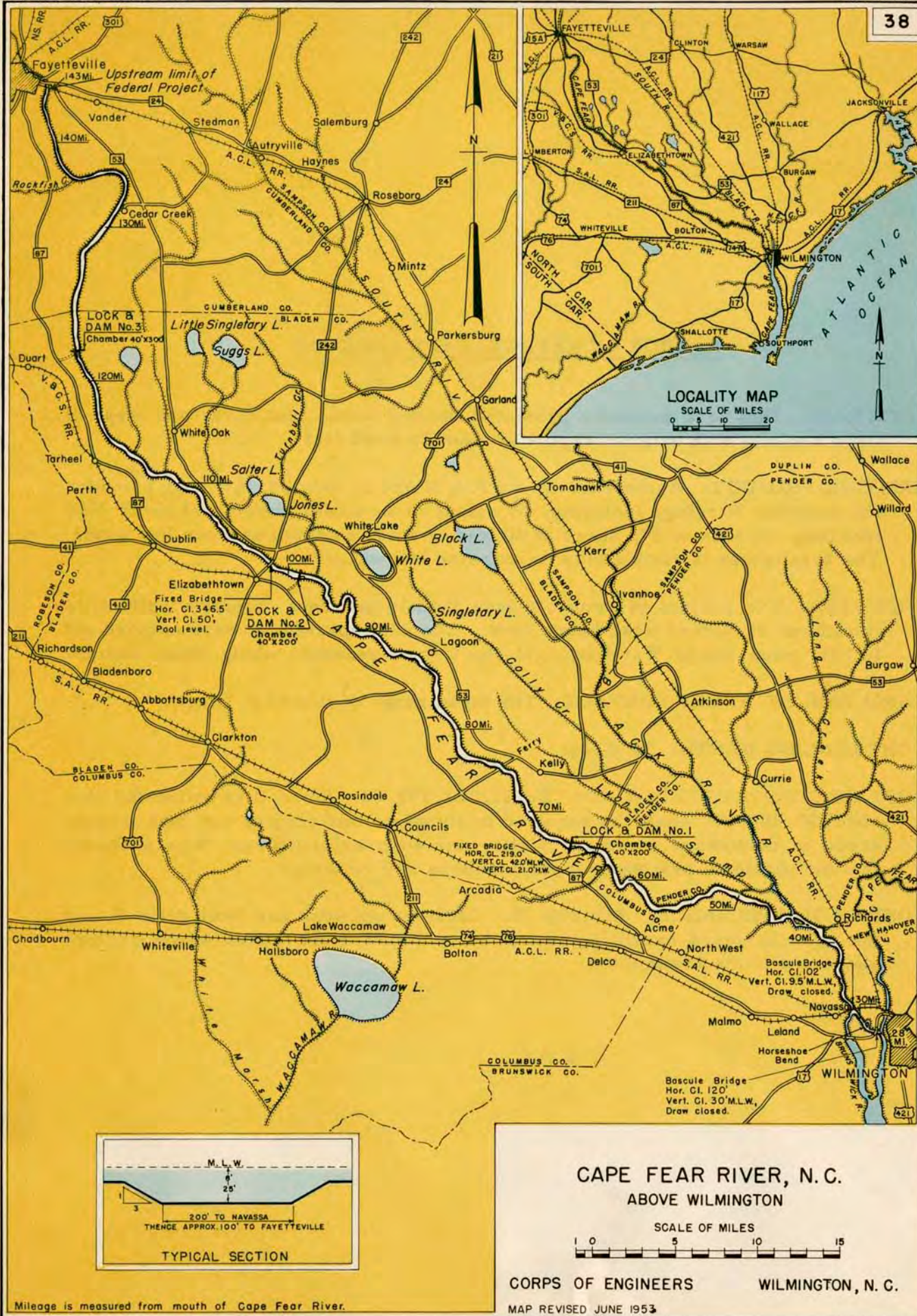
PROGRESS: The project is probably less than 14 per cent complete with little likelihood of further work being done. The last operations were carried out in 1917 when World War I brought the U-boat menace along these shores.

VARIATION OF WATER SURFACE: The mean range of tide is 3.7 feet.

CONTROLLING DEPTH: 30.0 feet.

COST OF CONSTRUCTION TO DATE: \$1,363,798.72. Since it is estimated that about \$8,800,000 would be required to complete this project and that present needs of commerce could not justify any such expenditures, it is probable that no additional new work or maintenance will be done.

COST OF MAINTENANCE: \$32,853.75. Little or no work has been done during the past 25 years except to repair some of the sand fences at the eastern shore end of the breakwater.



Mileage is measured from mouth of Cape Fear River.

CAPE FEAR RIVER ABOVE WILMINGTON

LOCATION: This river is formed by the confluence of the Deep and Haw Rivers, near Moncure, in Chatham County, N. C. It has a drainage area of about 8500 square miles.

PREVIOUS PROJECTS: Authorized by the R & H Acts of 1881 and 1902. Up to 1910 about \$150,000 was spent for the slackwater (no locks) project and about \$8178 for maintenance.

EXISTING PROJECT: Authorized by the R & H Acts of June 25, 1910; July 3, 1930; June 26, 1934; Aug. 30, 1935; Aug. 26, 1937 and provides for a navigable depth of 8 feet at low water from Navassa to Fayetteville, 115 miles above Wilmington, by the construction of three locks and dams and by dredging of river shoals between Navassa and Fayetteville; and for a dredged channel from Wilmington to Navassa (4 miles), 25 feet deep and generally 200 feet wide, with a cut-off across Horseshoe Bend and a turning basin approximately 550 feet long and 400 feet in average width at its head.

PROGRESS: Completed in 1935. The 25-foot channel from Wilmington to Navassa was completed in 1939.

TIDAL RANGE: Average, 3.4 feet at Wilmington to 1 foot at Lock No. 1, 39 miles above. Extreme, 6.4 feet at Wilmington and 1.5 feet at Lock No. 1. The maximum flood stage of record at Fayetteville is 68.9 feet U. S. W. B. gage, zero of which is 20.54 feet M. S. L.

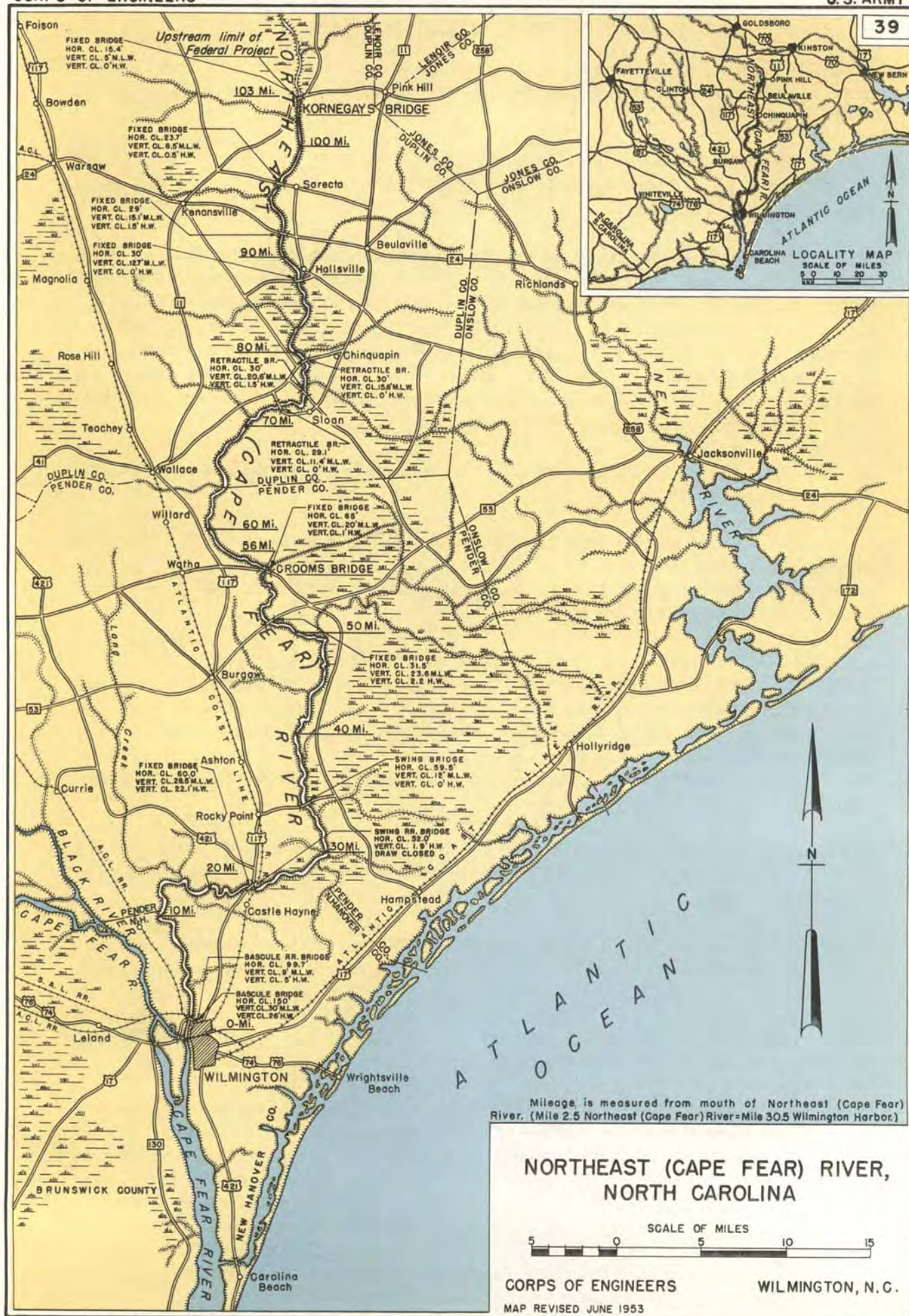
LOCKS AND DAMS: Lock and Dam No. 1 built 1911-1915, Lock and Dam No. 2 built 1917, and Lock and Dam No. 3 built 1934-35. In 1934 the lift of Lock and Dam No. 1 was increased 3 feet. Timber decking on downstream face of dam replaced with 12 inch concrete slab and pockets refilled with stone in 1943. Lock Nos. 1 and 2 have chambers 40 by 200 feet. The newest lock, No. 3, has 40 by 300 feet. Lock No. 1 has a lift of 11 feet while Nos. 2 and 3 have 9 feet.

CONTROLLING DEPTH: 22.0 feet from Wilmington to Navassa (4 miles); 18.0 feet to a point 9 miles above Wilmington; thence 5.6 feet to Fayetteville, 115 miles above Wilmington.

COST OF CONSTRUCTION: \$2,448,916 (includes previous project). Approximately \$2,136,000 was for the three locks (includes reconstruction costs).

COST OF MAINTENANCE: (Including previous projects) about \$1,640,000. For the 10 year period 1944-53 maintenance costs have averaged about \$82,000 annually, including the operation and care of the 3 locks (about \$30,000).

COMMERCE: In the 10 year period 1944-53 commerce has consistently increased from about 43,000 tons (including 12,000 tons of rafted logs) to about 600,000 tons during each of the last 3 years of 1951-53. The major portion of this traffic consisted of petroleum products to Fayetteville and over 250,000 tons of logs and pulpwood. In 1951 (the last year for which details are available) some 21,000 tons of phosphate rock from Florida (mostly via ocean-going barges) have moved to fertilizer plants near Navassa on the 25-foot channel. In 1951 it was estimated that the ton-mileage amounted to 53,613,281 or an average haul (over the subject waterway) of about 88 miles.



NORTHEAST (CAPE FEAR) RIVER

LOCATION: This river rises in northern Duplin County and flows 130 miles southerly, emptying into the Cape Fear River at Wilmington, 30 miles above its mouth. It should be noted that the lower 2.5 miles of this stream are part of the official Wilmington Harbor project.

EXISTING PROJECT: Authorized by the R & H Act of Sept. 19, 1890 and provides for clearing the natural channel for small steamers to Hallsville and for pole boats to Kornegays Bridge, 103 miles above the mouth.

PROGRESS: The clearing of the natural channel was completed in 1896. The river is in fair condition to a point 52.5 miles above the mouth.

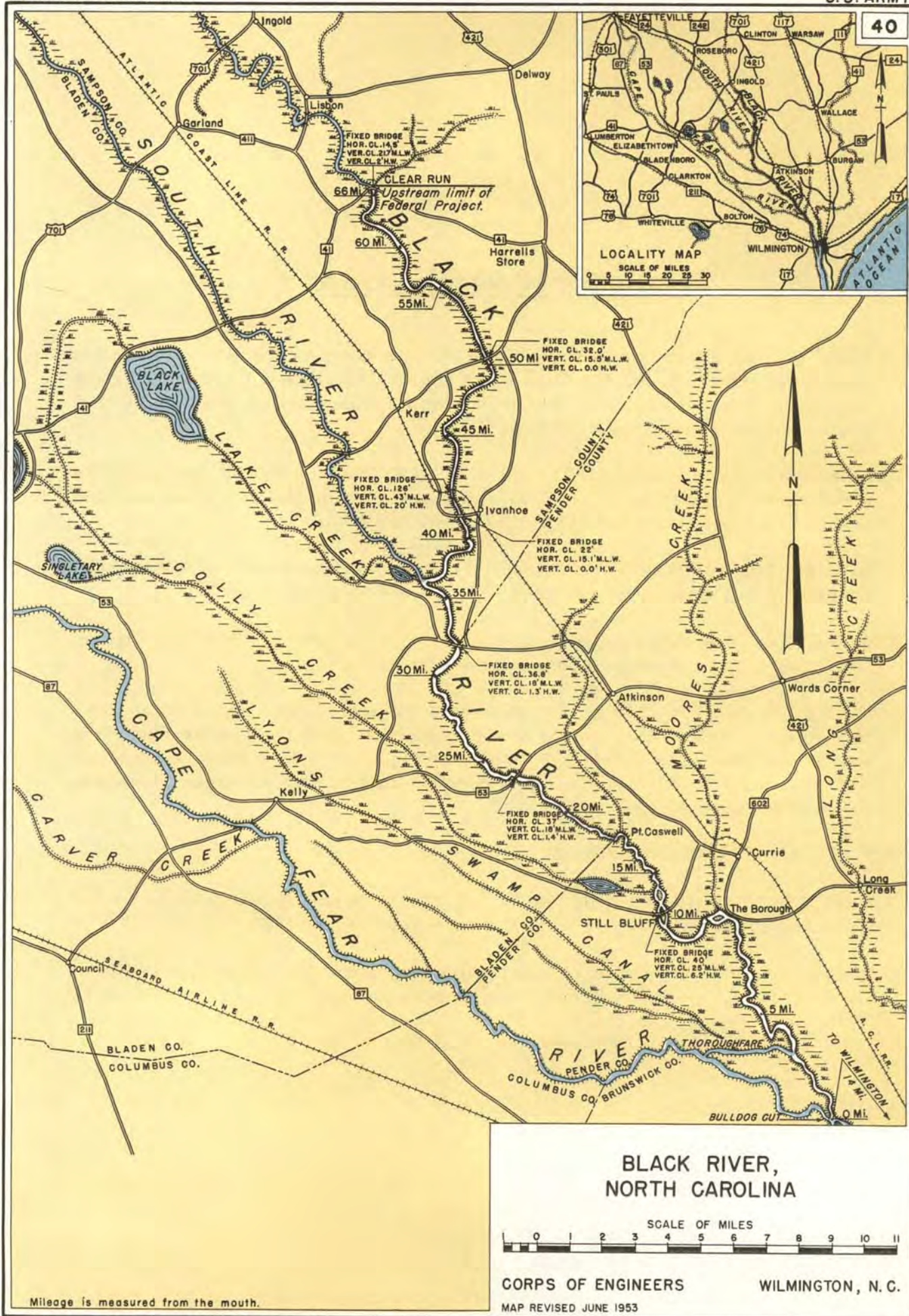
TIDAL RANGE: The tide ranges from about 3.4 feet at the mouth of this stream to nothing a short distance above the 48 mile board.

CONTROLLING DEPTH: The governing depths from the lower limits of the project (mile 2.5 above the mouth) are 6.0 feet to a point 48 miles above the mouth; and thence 3.0 feet to Crooms Bridge, 56 miles above the mouth. Above Crooms Bridge the river is navigable only during freshets, which are liable to occur any month of the year.

COST OF CONSTRUCTION: \$10,687.96

COST OF MAINTENANCE: \$61,138.57. Little work has been done in recent years except some snagging in 1944 at a cost of about \$1900.

COMMERCE: Although traffic reached a total of about 27,500 tons in 1942, of which 16,000 tons were rafted logs, commerce had all but disappeared by 1949, none being reported in 1950-52. However, incomplete advance data for 1953 shows nearly 3000 tons of commerce.



BLACK RIVER

LOCATION: Black River rises in Sampson County, flows 175 miles in a general southeasterly direction, and empties into Cape Fear River 14 miles above Wilmington and 44 miles above the mouth. It has a drainage area of about 1410 square miles.

EXISTING PROJECT: Authorized by the R & H Act of Aug. 5, 1886 and provides for clearing the natural channel and banks to Clear Run, 66 miles above the mouth, and cutting off sharp bends.

PROGRESS: Completed 1895.

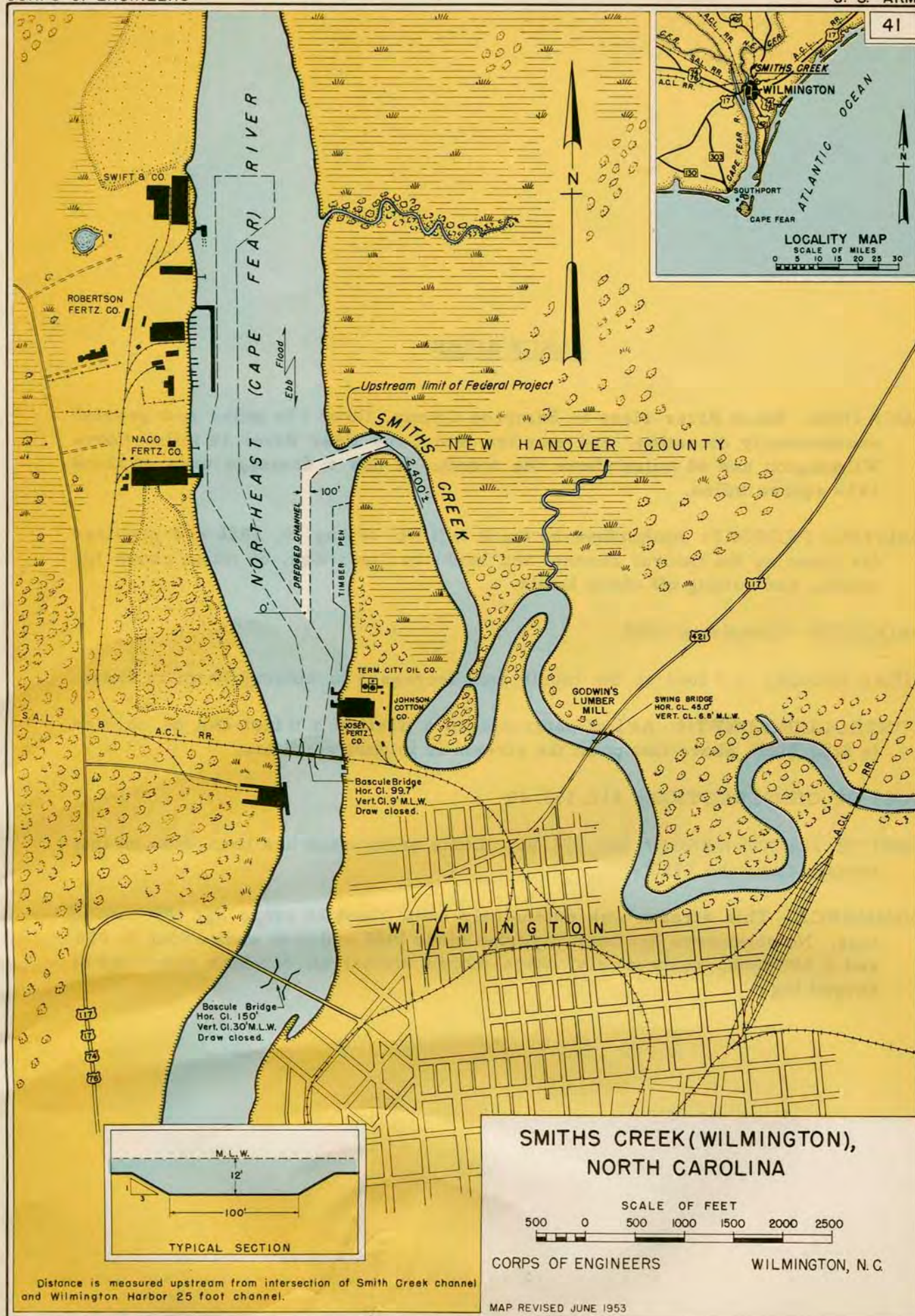
TIDAL RANGE: 1.5 feet at the mouth and decreases to nothing 30 miles above.

CONTROLLING DEPTH: At low water stages a draft of 3.0 feet can be carried to Still Bluff; above that point the stream is in poor condition.

COST OF CONSTRUCTION: \$12,358.40

COST OF MAINTENANCE: \$36,071.85. Little or no work has been done on this stream since the 1930's.

COMMERCE: This stream was extensively used about 25 years ago for rafting logs. No commerce has been reported since 1948 and 1949 when about 15,000 and 6,600 tons, respectively, were moved almost all of which consisted of barged logs.



SMITHS CREEK (WILMINGTON)

LOCATION: Smiths Creek is a small tributary of the Northeast (Cape Fear) River, which it enters from the east just above Wilmington.

EXISTING PROJECT: Authorized by the R & H Act of Aug. 30, 1935 and provides for a channel 100 feet wide and 12 feet deep at mean low water through the bar at the mouth.

PROGRESS: Completed in 1937.

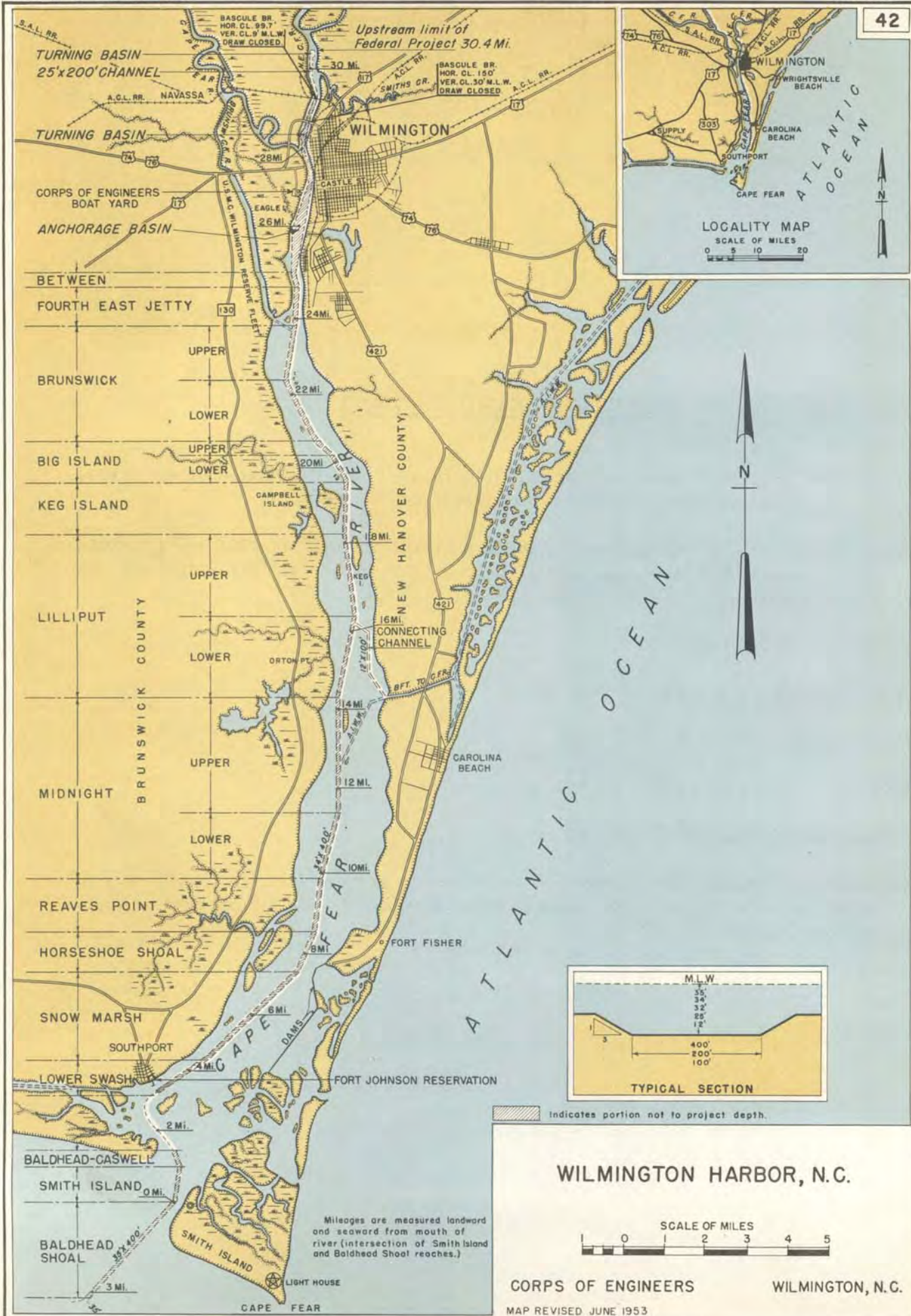
TIDAL RANGE: 3.4 feet.

CONTROLLING DEPTH: 10.6 feet.

COST OF CONSTRUCTION: \$8,507.45

COST OF MAINTENANCE: \$17.61

COMMERCE: Traffic has decreased consistently from a high of 16,300 tons of rafted logs in 1942, to 4,300 tons in 1951; 800 in 1952 and 500 in 1953. (Again all logs but via barge).



WILMINGTON HARBOR

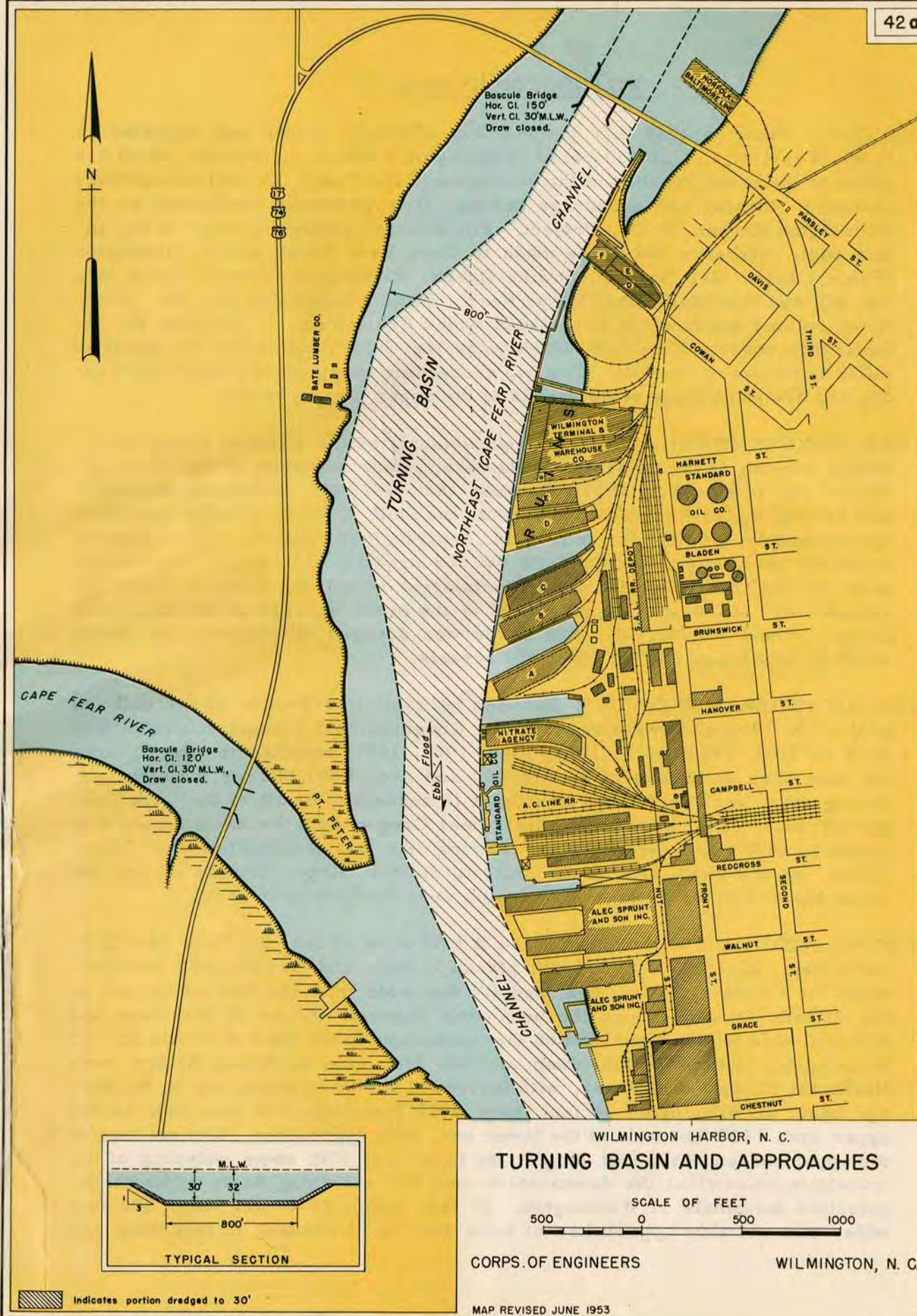
LOCATION: Prior to 1949 this project was officially known and reported as "Cape Fear, N. C., at and below Wilmington." Since it includes about 2.5 miles of the lower reaches of the Northeast (Cape Fear), as well as auxiliary channels, turning and anchorage basins, it is presently designated as the Wilmington Harbor, N.C., Project. For a more complete picture of the entire port, reference should be made to Cape Fear River above Wilmington (Project Index Map No. 38); Smiths Creek, Wilmington (Project Index Map No. 41); and Northeast River (Cape Fear - Project Index Map No. 39). Additional related information is included under Project No. 1, covering the Atlantic Intracoastal Waterway which joins the Cape Fear River for about 10 miles in its lower reaches. The two succeeding sub-project Index Maps Nos. 42a and 42b show large scale details of the upper turning basins.

OTHER IMPROVEMENTS: The first improvement, by the Federal Government, of this stretch of the river was undertaken under authority of the River and Harbor Act of March 2, 1829. Between 1822 and 1829, before improvement was started by the Federal Government, the State of North Carolina expended approximately \$70,000 for jetties and dredging. In addition to this, private interests have expended about \$150,000 for dredging in front of their terminals. In 1947 the U.S. Maritime Commission completed a lay-up basin for excess units of the war shipping fleet in the lower reaches of the Brunswick River. About 12,000,000 cubic yards was dredged to construct the basin which is capable of storing about 450 vessels.

PREVIOUS FEDERAL PROJECTS: Between 1829 and the adoption of the existing project in 1912 numerous reports and Congressional authorizations (R & H Acts of 1854, 1870, 1873, 1874, 1890, 1902, 1907) resulted in expenditures for new work in excess of \$4,625,000 and over \$600,000 for maintenance. Among other work performed New Inlet (a secondary mouth of the Cape Fear and not to be confused with the inlet near Oregon with the same name) was closed in 1876 and a defensive, or training dike was constructed from Zekes Island, on the south side of the inlet to Smiths Island. Depths across the ocean bar and in the river to Wilmington were dredged to 26 feet.

EXISTING PROJECT: Authorized by the R & H Acts of July 25, 1912; March 2, 1919; Sept. 22, 1922; July 3, 1930; March 2, 1945; and May 17, 1950 and provides for a channel 35 feet deep and 400 feet wide from the 35-foot contour in the Atlantic Ocean through the ocean-bar channel, thence 34 feet deep and 400 feet wide to the upper end of the anchorage basin (foot of Castle St.) at Wilmington, thence 32 feet deep and 400 feet wide to Hilton Bridge over Northeast (Cape Fear) River, with increased widths at bends; for an anchorage basin at Wilmington 34 feet deep, 2000 feet long, 900 feet wide at the upper end, 1100 feet wide at the lower end, with approaches 1500 feet long at the upper end and 4500 feet long at the lower end with some widening of the transition channel at the downstream end; for a turning basin opposite the principal terminals at Wilmington, 32 feet deep, 1000 feet long, 800 feet wide, with suitable approaches at each end; for a channel 12 feet deep and

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100 feet wide in the Cape Fear River, from a point near the eastern entrance of the Intracoastal Waterway to a connection with the main river channel at a point about 3 miles above; and for a channel 25 feet deep, 200 feet wide, from Hilton Bridge over Northeast (Cape Fear) River to a turning basin of the same depth, 600 feet wide, 1 1/4 miles above.

PROGRESS: The existing project is 61 per cent complete. Dredging the 25 by 200-foot channel and basin in Northeast (Cape Fear) River was completed in 1948. Dredging the 12 by 100-foot connecting channel to the Intracoastal Waterway was completed in 1948. Deepening and widening the river channel to 32 by 400 feet, enlarging and deepening the anchorage basin and southern approach thereto, and deepening the ocean-bar channel to 32 feet, was completed up to the foot of Castle Street in 1949. Deepening and widening the channel to 32 feet and 400 feet, respectively, above Castle Street has been indefinitely deferred. Increasing the width of the turning basin to 800 feet and widening the east side of the river channel to the harbor line, in the vicinity of the turning basin, all to a depth of 30 feet, was completed in 1949. No work has been done on deepening the ocean-bar channel to 35 feet and the river channel and anchorage basin to 34 feet.

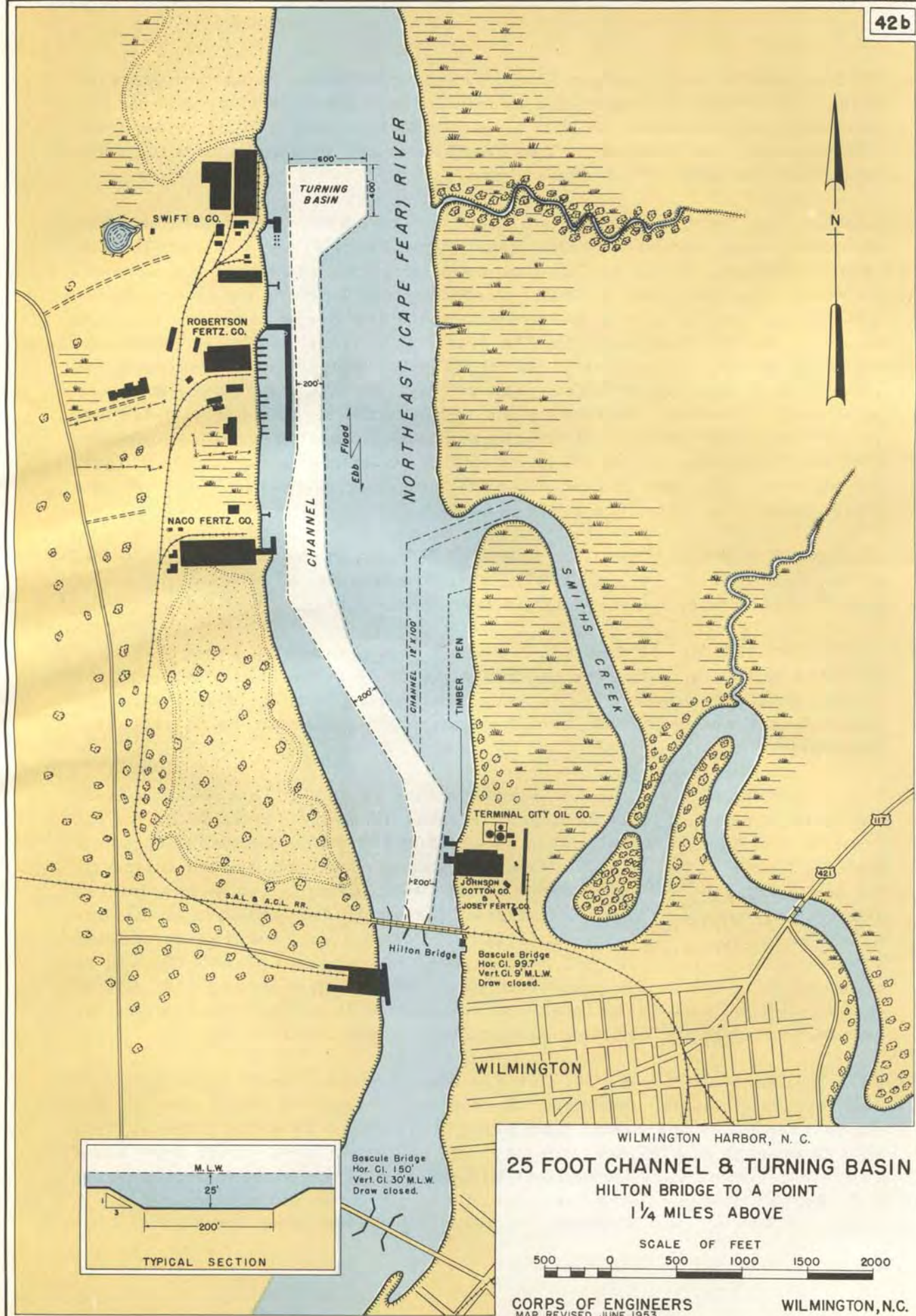
VARIATION OF WATER SURFACE: Average, 4.7 feet at the ocean bar, 3.6 feet at Keg Island, and 3.4 feet at Wilmington. Extreme, 8.5 feet at the ocean bar, 7.3 feet at Orton Cove, and 6.4 feet at Wilmington.

CONTROLLING DEPTH: 32.0 feet in the ocean-bar channel; 30.1 feet to the foot of Castle Street, including the anchorage basin; 29.8 feet to and including the turning basin; 25.0 feet to and including the turning basin in Northeast (Cape Fear) River; and 10.6 feet in the connecting channel to the Intracoastal Waterway.

COST OF CONSTRUCTION: \$8,729,326.47 to June 30, 1953. This includes funds expended by the Corps of Engineers on the "PREVIOUS PROJECTS," i. e., prior to 1912, but does not include expenditures of other agencies such as the State of North Carolina, U.S. Maritime Commission and private interests. No new work has been done since fiscal 1949, during which year a total of about 5,088,000 cubic yards of material (new work and exclusive of maintenance) were dredged at a cost of \$1,005,000 or an average unit price of about 18 cents a cubic yard. In 1953 it was estimated that about \$2,600,000 will be required to complete the project as now authorized; however, \$505,800 of this amount pertains to the indefinitely postponed deepening and widening the channel to 32 feet and 400 feet, respectively, above Castle Street.

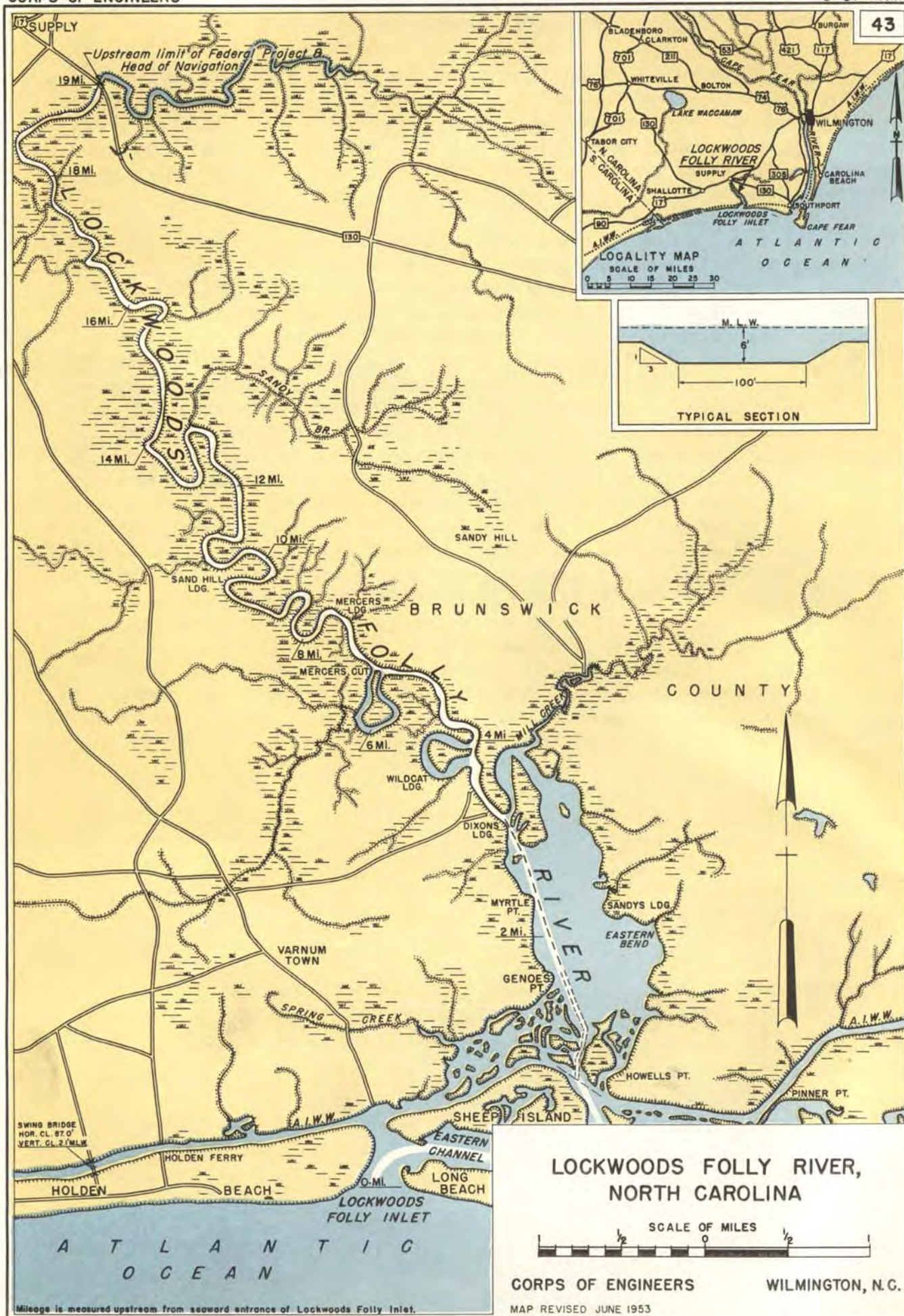
COST OF MAINTENANCE: \$7,741,746.78, which includes about \$600,000 spent on Previous Projects. Maintenance dredging is required every year and for the past ten years has varied from \$123,500 (1945) to \$504,000 in fiscal 1953, with an average of \$267,000. During 1953 unit costs have varied from about 10 cents per cubic yard for work (1,028,000 yards) on Baldhead Shoals by the U. S. hopper dredge "Gerig" to 32 cents and more for contract dredging. A small (20,000 cu. yd.) contract for removing shoals from the 12-foot con-

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necting channel with the Atlantic Intracoastal Waterway cost in excess of 36 cents a cubic yard. A current (1954) dredging contract in this reach involving nearly 18,000,000 cubic yards in connection with the U.S. Sunny Point ammunition loading terminal was awarded in 1953 at approximately 15 cents a yard. The latest (1953) approved estimate for annual cost of maintenance is \$500,000.

COMMERCE: For the 5 year period 1947-51 commerce averaged 3,384,100 tons annually and had shown a consistent increase for 10 years through 1951 when it totaled 4,495,400 tons. Slight decreases were reported in 1952 and 1953 when 4,048,000 and 4,089,000 (preliminary data) tons, respectively, were moved. According to advance information for 1953 which is subject to revision, over half of the tonnage consisted of petroleum products (2,878,000 tons) most of which moved by coastwise tankers from Louisiana and Texas. Various fertilizer materials (nitrates, phosphates, etc.) accounted for about 260,000 tons and pulpwood some 510,000. A "through" shipment, via the Intracoastal Waterway, of 210,000 tons of paper was reported. Relative to foreign traffic, imports amounted to 194,000 tons and exports were about 26,000, the latter including 12,500 tons of tobacco, 11,700 tons of cotton seed meal and 1540 tons of dried milk. The above commerce includes traffic at Southport and intermediate docks and terminals. For instance about 21,660 tons of menhaden (for oil extraction, etc.) plus some 870 tons of edible fish and shellfish came into Southport, even though the 1953 shrimping season there was reported as the poorest in 20 years. In addition to smaller vessels 265 steamships drawing up to 32 feet were recorded as using this port. Completion in 1952 of the State Ports Authority terminal at Wilmington and the U.S. ammunition loading facilities now under construction at Sunny Point (on the west side of the Cape Fear River below Wilmington) should tend to increase traffic through this port in the next few years.



LOCKWOODS FOLLY RIVER

LOCATION: Lockwoods Folly River is a small stream about 50 miles long, lying wholly in Brunswick County, which empties into the Atlantic Ocean 12 miles west of the mouth of the Cape Fear River.

EXISTING PROJECT: Authorized by the R & H Act of Sept. 19, 1890 and provides for a channel 100 feet wide and 6 feet deep at low water from the ocean to the bridge at Supply, 19 miles above, to be secured by dredging through oyster rocks and mud flats.

PROGRESS: The project is about 10 per cent complete. Prior to 1940 no work had been done on this project since 1897.

VARIATION OF WATER SURFACE: The average rise of the tide is about 4.5 feet near the inlet and 2 feet at Supply.

CONTROLLING DEPTH: Between the Intracoastal Waterway and Genoes Point, 4.0 feet, thence 3.0 feet to Supply, 19 miles above the mouth, the head of navigation.

COST OF CONSTRUCTION TO DATE: \$17,818.50. It was estimated in 1953 that \$147,700 would be required to complete the project.

COST OF MAINTENANCE: \$13,093.92. The last work was done in 1945 when about \$1,930 was expended.

COMMERCE: From the high of about 36,000 tons in 1947, of which all but 234 tons was pulpwood, commerce decreased abruptly to less than 100 tons (almost entirely fish and shellfish) for the past 6 years, 1948-53.



SHALLOTTE RIVER

LOCATION: Shallotte is a small stream in Brunswick County, rising in the large swamp country between Cape Fear and Waccamaw Rivers known as Green Swamp. It flows into the Atlantic Ocean about 20 miles west of the mouth of Cape Fear River.

PREVIOUS PROJECT: The R & H Act of 1907 appropriated \$3000 to be expended on this stream.

EXISTING PROJECT: Authorized by the R & H Acts of Mar. 4, 1913; Jan. 21, 1927 and provides for securing a channel 4 feet deep at mean low water and 36 feet wide from the mouth to the town of Shallotte. (A restudy has been authorized to determine the advisability of providing a deeper channel).

PROGRESS: Completed in 1929.

TIDAL RANGE: The rise and fall of tide varies from 5 feet at the mouth to 3 feet at the town of Shallotte.

CONTROLLING DEPTH: 2.0 feet.

COST OF CONSTRUCTION: \$15,181.37

COST OF MAINTENANCE: \$6,467.81. No work has been done since 1929.

COMMERCE: For the past 5 years (1949-53) commerce has averaged about 290 tons, composed entirely of seafoods, mostly shellfish.



SHALLOTTE RIVER

LOCATION: Charlotte is a small stream in Brunswick County, rising in the large swamp country between Cape Fear and Waccamaw Rivers known as Green Swamp. It flows into the Atlantic Ocean about 50 miles west of the mouth of Cape Fear River.

PREVIOUS PROJECT: The R. H. Act of 1907 appropriated \$3000 to be expended on this stream.

EXISTING PROJECT: Authorized by the R. H. Act of Mar. 4, 1913, Jan. 21, 1917, and provided for securing a channel 2 feet deep at low water and 30 feet wide from the mouth of the river to the town of Charlotte. (A study has been authorized to determine the advisability of providing a deeper channel.)

PROGRESS: Completed in 1917.

TIDAL RANGE: The rise and fall of the water from 5 feet at the mouth to 1 foot at the town of Charlotte.

CONTROLLING DEPTH: 2.0 feet.

COST OF CONSTRUCTION: \$18,181.37.

COST OF MAINTENANCE: \$6,467.81. No work has been done since 1917.

COMMENTS: For the past 5 years (1917-22) commerce has averaged about 150 tons, composed entirely of oysters, mostly shellfish.

